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Silvering Plastics

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Evaluating Industrial Wastes

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Designation of Metallic Surfaces

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in the field of *Zinc Die Castings*

Zinc as a metal is not particularly difficult to finish. Being relatively soft, you have to watch out for scoring and dragging, of course, but other than that the problem is usually one of degree. How much should the surface be processed prior to plating and what's the best way of doing it? Remember proper pre-plate finishing can do away with surface defects that plating could not hope to hide.

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METAL FINISHING

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Thin Plating and Thinner Ice

The prevailing short supply of plating metals has already resulted in some circumvention of commercially accepted specifications for plating thicknesses, and will probably result in further short cutting of quality.

This is a regrettable, albeit expedient, state of affairs, and one which, if not carefully controlled, can do considerable harm to the plating industry. On the one hand, it breeds contempt for specifications generally; even when materials again become readily obtainable platers and consumers both are inclined to take the attitude that "when we couldn't get metal we only put on half as much plating and we got away with it."

Then too, it can result in skimping to a point where adequate protection is endangered, with the result that the already too prevalent sight of inadequate plating jobs is made more obvious. In either case there results a rapid undoing of years of promotional and educational effort to sell quality plating to platers and consumers alike. Let us never forget that for a high percentage of its uses plating faces serious competition from plastics, stainless steel, organic coatings, and other decorative materials. Inadequate plating which results in customer dissatisfaction can easily sway demand away from plated finishes in these cases, causing a substantial loss to the plating industry.

Before bowing to the dictates of short metal supplies by cutting down on plating thicknesses, the conscientious plating engineer should take every possible step to conserve what materials are available. Attention to such details as complete utilization of anodes, dragout recovery, less concentrated plating baths, prevention of leakage losses, well insulated racks, better plate distribution, etc., can result in surprising stretching of materials and production economies — economies that can easily be carried over into normal times (whatever they are!) as permanent cost-reducing procedures.

In cases where the short supply of essential materials would only permit plating thicknesses which are almost certain to be unsatisfactory in service, those who make the decisions should be urged to use an alternate finish, at the same time advising all concerned, *especially* the purchaser of the items, that the finish is an emergency item, and not to be compared with the usual high quality plated finish. In this way, subsequent high quality plated finishes may escape the wrath that sub-standard jobs are certain to incur.

In the long run, no plating at all would be better than inferior plating, and those who choose to tread on thin ice by ignoring the facts are jeopardizing a reputation the entire industry has spent years in establishing.

W. A. Raymond

Editor

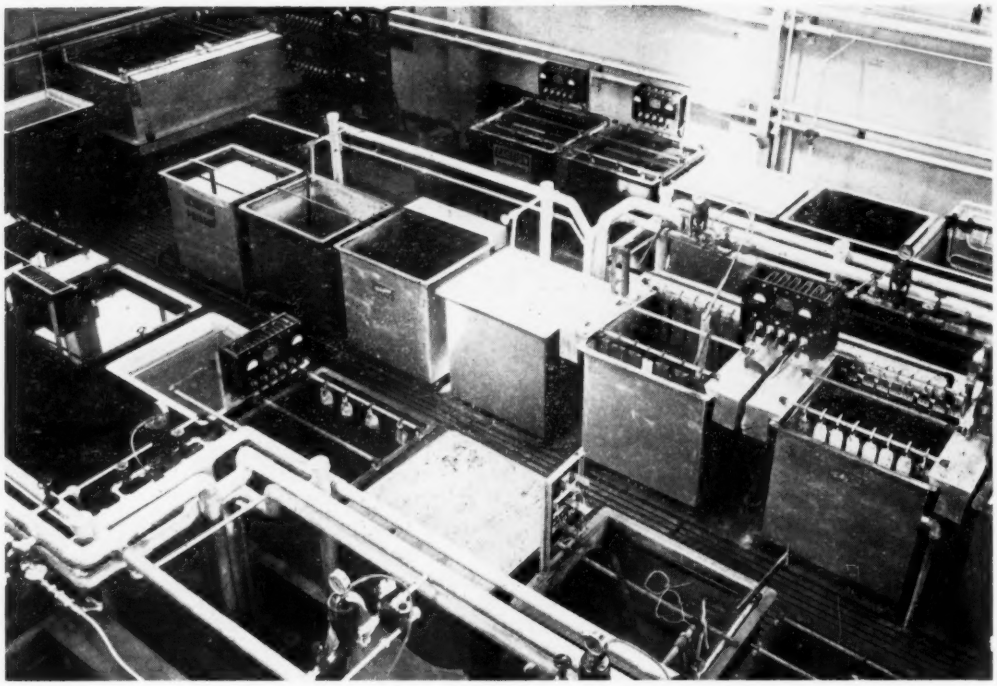


Figure 1. General view of the plating room. The chrome plating tank is in the upper left background.

(Official U. S. Navy photograph)

The Navy's Newest Electroplating Shop

By George W. Grupp, *Washington, D. C.*

THE newest and most complete experimental electroplating shop of the Navy, now in operation in the Michelson Laboratory at the United States Ordnance Test Station at Inyokern, Calif., was built at a total cost of $191,500 of which $145,000 was for that part of the laboratory building occupied only by the electroplating shop and $36,000 for the electroplating equipment.

The purposes of this electroplating shop are threefold. First, it will conduct applied research on assigned projects to develop new and to improve old electroplating processes and techniques. Second, on an experimental basis, and consistent with research objectives, it aims to render maximum technical assistance to the various departments of the Station. Third, it will collect and analyze electroplating production data to establish standard practices for new electroplating processes.

Captain *W. V. R. Vieweg*, USN, is the Commander of the Naval Ordnance Test Station at Inyokern; and the electroplating shop, which is a unit of the Design and Production Department of the Michelson Laboratory, is under the direction of *Mr. D. C. Webster*.

The original specifications for the shop and its equipment were prepared by *Mr. K. H. Booty*, now assistant head of the Naval Ordnance Test Station's Design and Production Department, and *Mr. Jack Raskin* of L. H. Butcher Co.

The primary function of this electroplating shop is to apply surface finishes to the first 100 parts of any kind of ordnance designed and produced at this Station. Subsequent larger orders will be placed with private contractors. The exception to this policy is "filler orders;" some low-priority production orders will be completed in this shop to enable more efficient use of shop personnel during change-over periods. The shop will also perform decorative plating and hard-chrome build-up for the Navy's Public Works Dept.

In addition to standard plating processes, there are several special plating techniques to be used in this shop: (1) nickel plating by chemical reduction; (2)

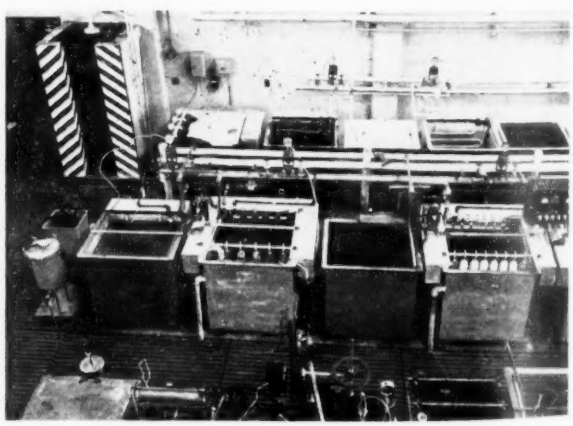


Figure 2. Safety shower (upper left) installed in the plating room provides deluge of water in case of spilled chemicals on clothes or bodies of workers.

(Official U. S. Navy photograph)

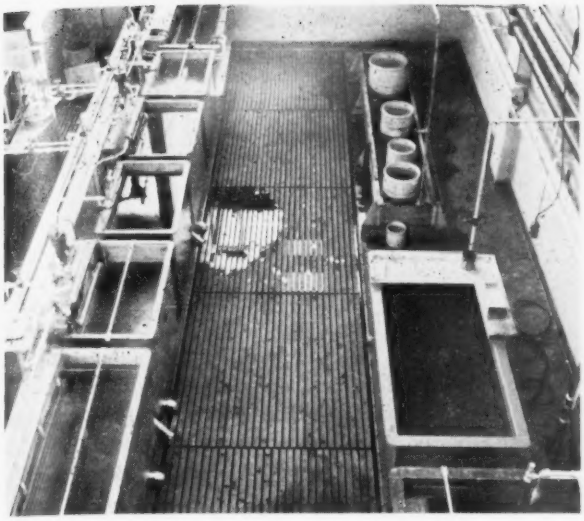


Figure 3. View of the sulfuric acid anodizing and dye coloring line (left).
(Official U. S. Navy photograph)

plating on aluminum; (3) electroforming silver, copper and chromium parts, and (4) electroplating silver on polystyrene and other plastics.

The electroplating shop, which occupies the west end of the Heat Treating Wing of the Michelson Laboratory, is isolated from the remainder of the wing by steel swinging doors and a 12" concrete wall. This over-all 61' x 40½' one-story shop with a basement of the same dimensions has a 12½' high ceiling in the basement, and a 25' high ceiling for the ground floor to provide ample space for the overhead fume and dust removing systems.

The shop is provided with plenty of daylight from the large windows extending the full length of north and south sides of the shop. In addition, daylight enters the shop through the windows of the sawtooth roof.

The arrangement and size of the various tanks in this shop can be gleaned from the accompanying equipment arrangement photos. An elevator was installed to operate between the basement and the ground floor to supply the needs for the shop. The shop is also served with two 2,500 pound capacity overhead monorail cranes. As a safety measure a shower bath was installed in the shop.

For further protection of the workers in the shop the tanks are provided with an extensive stainless steel fume exhaust system, with four blowers which drive the dangerous fumes up four concrete stacks into the atmosphere.

In addition to the fume exhaust system the shop is air conditioned by a 40,000 CFM adiabatic cooler. The air entering the shop is washed in a water spray.

Plating Baths

The shop is equipped with a sulfuric acid anodizing tank which has a capacity of 250 gallons, another 600 gallon chromic acid anodizing tank, and tanks for eleven different kinds of plating, as follows:

(1) Cadmium — 360 gallons.
(2) Zinc — 180 gallons.
(3) Cyanide Copper — 180 gallons.
(4) Acid Copper — 180 gallons.
(5) Nickel (Watts Type) — 180 gallons.
(6) Stainless steel strike (High chloride nickel) — 180 gallons.
(7) Silver strike — 50 gallons.
(8) Silver — 50 gallons.
(9) Indium — 6 gallons.
(10) Acid Tin — 50 gals.
(11) Chromium — 350 gallons.

The oxidizing equipment consists of two tanks. The one for giving steel a black oxide coating is a 180 gallon tank heated with electric immersion heaters. The other 180 gallon tank is used to give brass and copper a black oxide coating. The bath consists of sodium hydroxide and sodium chlorite.

The shop also has an electrically heated, mechanically agitated 2' x 2' x 6' experimental electroforming tank which uses an acid copper solution.

Each of the five cleaning tanks are used for specific purposes as shown in the following tabulation:

(1) Direct clean — 180 gallons.
(2) Reverse Clean — 180 gallons.
(3) Electroclean and strip chromium — 180 gals.
(4) Aluminum non-etching cleaner — 150 gallons.
(5) Aluminum etching cleaner — 150 gallons.

The shop also has one 110 gallon vapor-slush type degreasing tank which uses trichlorethylene; one 180 gallon electrolytic pickling tank; 13 cold water dam-type overflow rinse tanks whose capacities range from 180 to 360 gallon; and two hot water rinse tanks.

Most of the tanks are heated with steam coils, temperature in each tank being controlled with automatic regulators.

Two solution filters are used in this shop.

All plating racks are being made by the platers to suit the particular jobs in hand.

The available power of the shop includes one 4000 amp. 6 volt MG set; one 1000 amp. 40 volt MG set, and three 1500 amp. 6 volt rectifiers.

In another section of this shop there is a buffing and polishing lathe and a sandblasting machine.

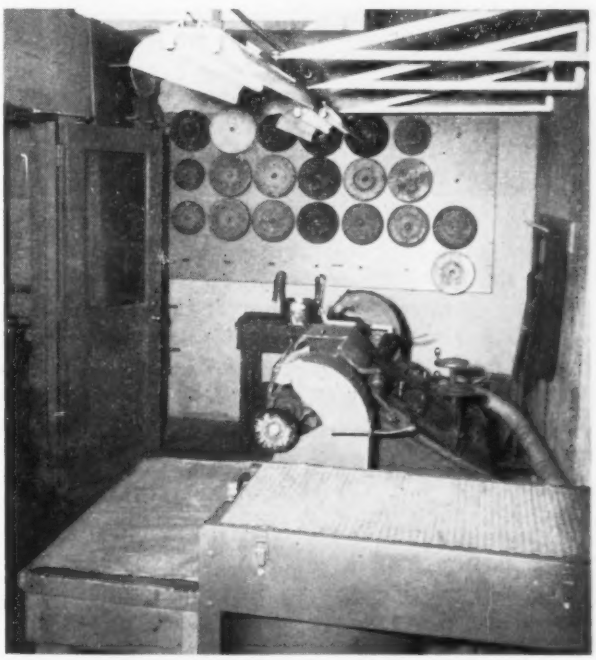


Figure 4. Polishing room adjacent to the plating shop for preparing and color buffing parts.
(Official U. S. Navy photograph)

Vacuum Plating of Metals and Plastics

By T. M. Navoy, *Dorchester, Mass.*

Mr. Navoy is a chemist active in the job plating and plastic metallizing fields. Until 1945 he was connected with the Rustproofing and Metal Finishing Co. of Cambridge, Mass. He is now with Industrial Enamelling Corp., Boston and Quincy Plating Corp., Quincy, as well as conducting a private consulting practice.

VACUUM plating, or more formally metal evaporation, is a relatively new development in the art of depositing metals. Used in a small way before the war to make opticals reflectors, it has since come into its own as a production method for depositing a brilliant metallic coating on glass, plastics or metals.

The film produced has high lustre and brilliance without any polishing or buffing. While it does not have the durability of an electroplated deposit, it is, after lacquering, entirely suitable for many decorative applications.

It is already superseding conventional electroplating for some applications. Several manufacturers of flashlights have replaced the conventional nickel-plated steel reflectors with a molded plastic reflector metallized by vacuum evaporation. Even metal reflectors are being given an undercoat of clear enamel to give a gloss to the surface and are then metallized. It is used to an increasing extent on such articles as novelty jewelry, combs, barrettes, gift items, fancy closures, medallions and escutcheons, plates, toys and other articles where a brilliant metallic finish is desired.

Modifications of this method are used to continuously deposit silver or aluminum on rolls of plastic sheeting as the sheeting is wound from one roller to another in a vacuum chamber. This metallized sheeting is used for gift wrappings and stamped into sequins for dress ornaments. Rolls of Kraft paper are continuously coated with zinc to make an improved type of electrical condenser.

Principles of Vacuum Metallizing

Vacuum coating is based on the fact that when a metal is vaporized in a high vacuum, the vaporized metal will travel in straight lines until it hits an obstruction and will condense on the surface of that obstruction. Basically then, a vacuum coating machine is a chamber capable of holding a vacuum, a set of pumps to produce rapidly the vacuum needed, and a means of heating the metal to be vaporized to its boiling point.

In normal production work the vacuum chamber is a horizontal cylinder 4 feet in diameter and 4 feet long. One end of the chamber is hinged to allow access to the interior. Work to be coated is racked along the inner circumference of the chamber. The coating metal is vaporized from a series of resistance coils suspended along the central axis of the chamber. Since the vaporized metal travels in straight lines, recessed or irregular objects are coated by racking them on rotating jigs.

To evacuate the coating chamber with its load of plastic to the requisite vacuum of .5 micron or less in 20-30 minutes, a combination of mechanical and diffusion pumps is used. The diffusion pumps can attain the high vacuum necessary in a few minutes because of their tremendous pumping speeds. They cannot operate at atmospheric pressure however, but begin pumping only when the pressure in the system has been reduced to .2mm of Hg (200 microns). Also they require their exhaust to be expelled from the system being evacuated. One or more mechanical pumps are used to perform these latter two functions. The diffusion pumps can be considered as pumps in which the moving parts have been replaced by the diffusion of vapor from a boiling oil of high molecular weight through a series of jets. In appearance diffusion pumps are essentially vertical stainless steel casings 10 inches in diameter and three feet high, with a sidearm near the bottom. The upper half of the casing is water-cooled. A jet assembly shaped like a cylindrical lamp chimney, topped with a conical cap, fits inside the casing. Jet holes are placed at calculated distances in the periphery of both the cylinder and its cap. Metal skirts are placed over the holes to direct the oil vapors downward. The oil in the bottom of the casing is boiled by an electrical heating unit. The vapors from the boiling oil travel upwards inside the jet assembly or "chimney" and are discharged downward through the jet holes as a circular spray or vapor traveling at high velocity. The oil vapors striking the cool upper half of the casing condense and trickle back to the bottom where they are again vaporized. Molecules of air in the system being evacuated wander by their random motion into the upper half of the diffusion pump casing, which is open to the system. Here they are trapped by the vapor spray from the jets and carried downward with the vapors where they are expelled through the sidearm by the mechanical pump. A mechanical pump loses pumping speed rapidly as the pressure falls and will not reduce the pressure below 25 microns (.025 mm. of Hg) in a system such as we are using. Therefore the diffusion pumps may be regarded as concentrating the gases to be expelled from the coating unit and deliver-

ing them to the mechanical pump in compressed form for ejection from the system.

The evaporation is done from 16-24 tungsten resistance units each consisting of ten inches of 040" tungsten wire would helically into a coil 3/8" in diameter and 3" long. On each loop of these coils is hung a U of .070" aluminum wire (for aluminum coating) 1/4" long. This combination of tungsten as the heating unit and aluminum as the coating metal is used principally because molten aluminum has the property of wetting tungsten and adhering to it. Thus aluminum evaporating from a tungsten filament in the center of the coating chamber will coat in all directions from the center. Other metals may be used for coating, but must be evaporated from a crucible; in this case the path of travel of the vaporized metal is outward from the top of the container. Molybdenum can be used instead of tungsten as the heating unit, but it is very rapidly dissolved by the molten aluminum and the coils thus have a very short life.

These, then, are the basic components of a vacuum plating system. The general procedure of plating as practiced in a job shop doing a variety of objects is described below.

Work to be vacuum plated is racked on jigs and dipped in a primer coat of lacquer to fill in scratches and give a higher gloss to the surface. To avoid "runs" a time-draw dip machine is often used.

The metal film deposited on the plastic is at most only .0001 to .00001 inch thick. If the metallized object is to be handled at all, a protective topcoat of lacquer is necessary. Therefore a primer coat must be used which will give good adhesion to the object being metallized and at the same time be unaffected by the solvents in the lacquer topcoat to be used. This is done by using a thermosetting lacquer, which by baking is cured to a hard glassy mass, unaffected by solvents. On metal, glass and thermosetting plastics (plastic materials not softened by heat) almost any good baking synthetic can be used. On thermoplastic materials which begin to soften at 160°F., the choice is more difficult. A phenolic-based finish which is cured by baking at 140°F. for an hour is commonly used. After baking the work is racked in the vacuum chamber, the door sealed and the evacuation of the chamber begun.

In vacuum work pressure is measured in microns; one micron being defined as .001 mm. of mercury. Normal air pressure at sea level is measured as 760 mm. of mercury. The mechanical pump is used to lower the pressure in the tank from normal air pressure (approximately 760,000 microns) to 200 microns. At this point the efficiency of the mechanical pump falls off and the diffusion pumps begin to operate. Accordingly, the diffusion pumps are valved into the system and the mechanical pump is valved off the system and put to work backing up the diffusion pumps, pumping away the exhaust delivered by the diffusion pumps and expelling it from the system. Pumping is continued until the pressure in the tank has been reduced to .4 micron, the proper pressure for coating. Normally the entire pumping cycle takes about 20 minutes.

When coating pressure is reached, the tungsten resistance coils are switched on and held to a low red heat for 30 seconds. This drives off any volatile impurities on the coils. They are then turned on full to a bright white heat for a carefully timed pre-determined interval (10-30 seconds). It is during this interval that the actual plating is done. The tungsten resistance units are then switched off, the diffusion pumps are valved off from the chamber, and air is let into the chamber. The chamber is emptied and reloaded and another cycle begun.

The work just taken out of the chamber is now covered with a brilliant silvery coating of aluminum. This coating is thin and may be removed by hard rubbing. To protect it, the work is dipped in a top-coat of clear lacquer and allowed to dry.

If gold or other colors are desired, the lacquered work is dipped in dye baths of the proper colors, rinsed in water and dried.

Production Metallizing

As can be seen from the above schedule, the processing cycle is rather a long one. The complete cycle is summarized below:

1—Racking of plastic on jigs	30 minutes
2—Primer coat in time-draw dip	10 "
3—Bake at 140°F.	60 "
4—Metallizing in coating chamber	30 "
5—Top coat of lacquer in time-draw dip	10 "
6—Hardening of lacquer coat	30 "
7—Dye dip and rinse	5 "
8—Dry after rinsing	25 "
Total	200 minutes

Thus the coating machine averaging 2 cycles an hour will require seven sets of racks to keep it in continuous operation.

A force of 6 girls for racking, unracking and packing will be required, plus two men; one to supervise operations and operate the coating machine, and a service man to process work through the other stages.

Of the 20-30 minutes spent in processing work in the vacuum chamber only 30 seconds are required to do the actual plating. The rest of the time is spent in evacuating the chamber to the point at which plating is possible. Therefor the amount of work which can be processed through the machine each day depends primarily on the skill and diligence of the operator and on the speed with which factors which slow down pumping speeds are eliminated. Sixteen cycles per eight hour day is a good average production for a well-run unit.

Maintenance of Vacuum Equipment

Little maintenance is required to keep the coating machine operating efficiently if proper precautions are taken. The diffusion pump oil should never be exposed to atmospheric pressure when hot, because the hot oil decomposes at atmospheric pressure. If air is admitted to the system when the diffusion pumps are in operation and the oil is decomposed it is necessary to take down the diffusion pumps, clean out the cracked oil and replace it with new oil.

It is good practice to include a variable resistor or auto-transformer in the heating circuit of the diffusion pumps. The input of heat needed to produce maximum pumping speed in the diffusion pumps will vary with the fore pressure maintained by the mechanical pump and the temperature and pressure of the water going

through the cooling jackets, and occasional adjustments will be needed to keep the unit operating at full efficiency. Scale and rust accumulating in the water jackets of the pumps should be removed periodically to insure uniform cooling.

The operation of the mechanical pump is impaired tremendously by the presence of water vapors in the mechanical pump oil. This problem becomes particularly troublesome during hot, humid summer weather. It can be minimized by installing an oil purifying unit for the oil. This consists essentially of an oil reservoir in which the oil is kept hot by immersion heaters to drive off water vapors and other volatile impurities in the oil, and a cooling coil in which the oil is cooled before admittance to the pumps. Even with a purifying unit the oil should be replaced periodically with new pure oil.

The build-up of aluminum on the inside of the coating chamber and the fixtures in the chamber should be removed every week during the hot summer weather and every two weeks during winter. This is best done by washing the chamber with hot caustic solution until the aluminum either flakes off or dissolves completely, rinsing thoroughly with water and then drying by rinsing with acetone and allowing the acetone to dry. If the aluminum is allowed to build up it absorbs gases and water vapor which are slowly liberated while the chamber is being pumped down, significantly lengthening the pumping time. During evaporation the heat of the incandescent coils drives off more gases, causing a rise in pressure in the chamber during coating and resulting in a black or brown discoloration on the coating.

Another possible source of trouble is air leakage from outside into the vacuum system. In an assembled unit like a coating machine a certain amount of leakage is unavoidable and can be handled by the diffusion pumps. Excessive leakage will, however, increase the time required to obtain a coating vacuum, or can prevent its achievement completely. Leaks can be best prevented by using extreme care in the disassembling and assembling of the vacuum system. If a leak does occur it can be located by spraying the suspected portions of the system with acetone and watching the gauges of the system for a change in pressure. Either an increase or decrease in the pressure indicates a leak, in the former case because the acetone vapor has entered the system and in the latter case because the acetone has temporarily sealed the leak. The cause of the leak can then be determined and the leak eliminated.

In hot, humid weather the troubles mentioned above become more acute. The increased amount of moisture in the air slows down pumping speeds and contaminates oil rapidly. Only the most rigid precautions will allow cycles below 45 minutes whereas during the winter months 20 minute cycles are common practice.

Racking and Costs

The design of the object to be metallized and of the jig itself for rapid easy racking is very important and has a direct bearing on the cost of plating. An object like a toy racing car is held by two spring steel prongs spot welded to a metal bar and inserted under the body of the racer. Objects like combs which offer no recesses or projections for racking are held by driving a staple into their back. The staple is then gripped by spring steel prongs during the processing cycle and afterwards removed. Thus the only marks of racking on the finished piece are two pin holes in the back.

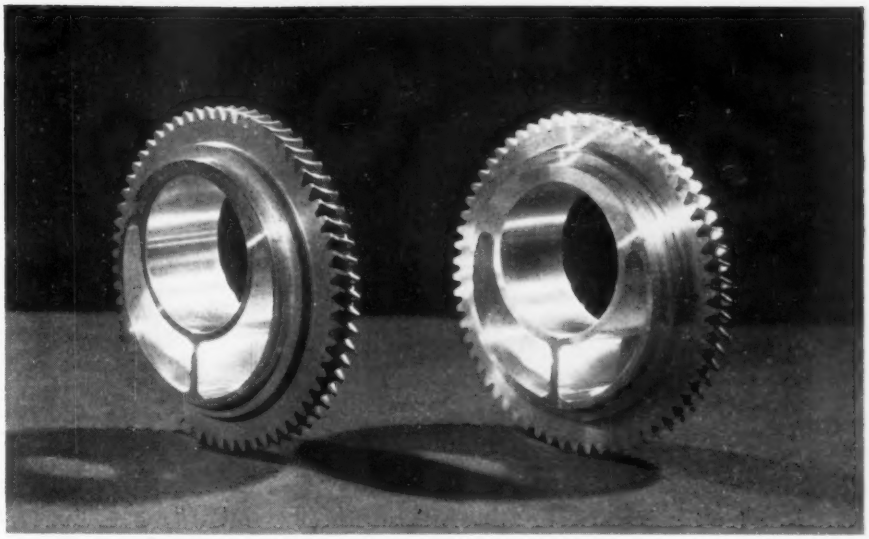
A coating unit as described above, with seven rotating racks arranged around the inner circumference of the chamber, should coat 1500 ladies combs or small toy racing cars per cycle. Assuming half hour cycles, it should process 24,000 such objects per eight hour day. Correspondingly larger amounts of smaller objects such as barrettes can be done.

The cost of aluminum used for coating is negligible, but the cost of tungsten is a considerable item. The molten aluminum erodes tungsten so that the filaments have a short life. With careful handling the filaments have a dependable life of four cycles, after which they should be replaced. In addition tungsten, especially after having once reacted with molten aluminum, is extremely brittle and therefore wastage is considerable. Filaments of stranded tungsten wire are more durable, but are harder to control for coating. Using 20 filaments in a coating machine running 16 cycles per eight hour day is a figure of $14.00 for tungsten consumed, which is not excessive. Services required by the coating machine will be approximately 10 kilowatts of power and 30-60 gallons per hour of cooling water for the mechanical and diffusion pumps.

Prices obtained by job shops metallizing objects like the comb and racer mentioned above vary from $20.00-$30.00 per thousand and up, depending on the size of the object and the ease with which it may be treated. By rule of thumb, each chamber of work processed is priced to bring a return of about $25.

For a vacuum plating set-up as described above a capital outlay of about $18,000 will be required, of which $12,000 will be for a coating machine and the balance for the auxiliary equipment necessary.

The field is still relatively new and open. Much research is being done to make vacuum plating cheaper and more efficient, and the coatings more durable and wear-resistant. As the product improves it is likely that the economies possible in moulding an article of plastic instead of fabricating it from metal will cause vacuum plating to be used more and more extensively as a substitute for decorative nickel, chromium, gold and silver plating.



Aluminum power gears-uncoated gear at right. The coated gear showed little wear after 891 cycles of operation.

New Hard Finish for Aluminum Alloys

A NEW scratch and wear-resistant hard coating for aluminum, which makes this light metal eligible for the first time in many applications heretofore largely monopolized by steel alloys, has been developed in the engineering laboratory of the *Glenn L. Martin Co.*, Baltimore, Md., as a part of its overall program of aeronautical research. Standard tests performed on an abrasion tester have shown the new coating to possess remarkable characteristics in this respect. After 50,000 wear cycles, for example, samples evidenced only half as much wear as did cyanide case-hardened steel. See Figure 3 for comparisons with other hard surfaced materials.

Designated as "MHC" finish, the new Martin hard coating for aluminum opens a way for the industry to take fuller advantage of the light-weight attribute of this metal in the manufacture of aircraft. For surfaces exposed to hard wear, it has been customary to use high-strength steel alloys, surface-hardened carbon steels, or chrome plate. In many cases the superior strength of the steel part is of no importance to its successful application. The weight saving effected through use of the Martin finish has already proved of considerable value in aircraft construction. In a typical instance, MHC-treated aluminum bearing races saved 40 lbs. over the conventional steel assembly.

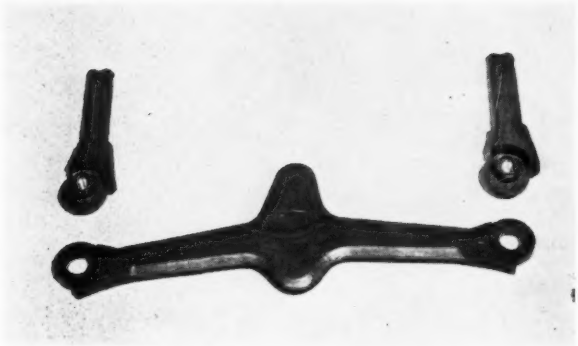
Bearing races and gear-teeth spacer, hard coated, improved wear resistance and saved 40 lbs. in weight.

Typical Applications

Though laboratory development has been under way for over two years, based on work accomplished by *Charles F. Burrows*, Martin research metallurgist, exploration of MHC's practical uses has thus far scarcely scratched the surface of its potential. Coatings have already been applied with outstanding success to such widely dissimilar items as gears and pinions, surveying instrument parts, turbine impeller blades, hand tools, swivel joints, friction locks, leading edges of high-speed airfoils, cans, pistons, and leg braces for paraplegics.

The Martin hard coating has proved out well in its application to the leading edges of high-speed airfoils, which are susceptible to wearing by the surface attrition of dust and rain. Helicopter rotor blade tips, which must often be revved up in clouds of dust, sand or cinders, represent another noteworthy adaptation. Taking advantage of the lighter metal, many direct MHC-finished aluminum substitutions for steel are being made today in the case of moving parts for Martin airplanes, as well as for static surfaces exposed to severe scuffing or other forms of wear.

A variety of items, from cylinders, bearing surfaces and jack-screw threads, which latter would seize if uncoated, to airplane door thresholds and mechanic's



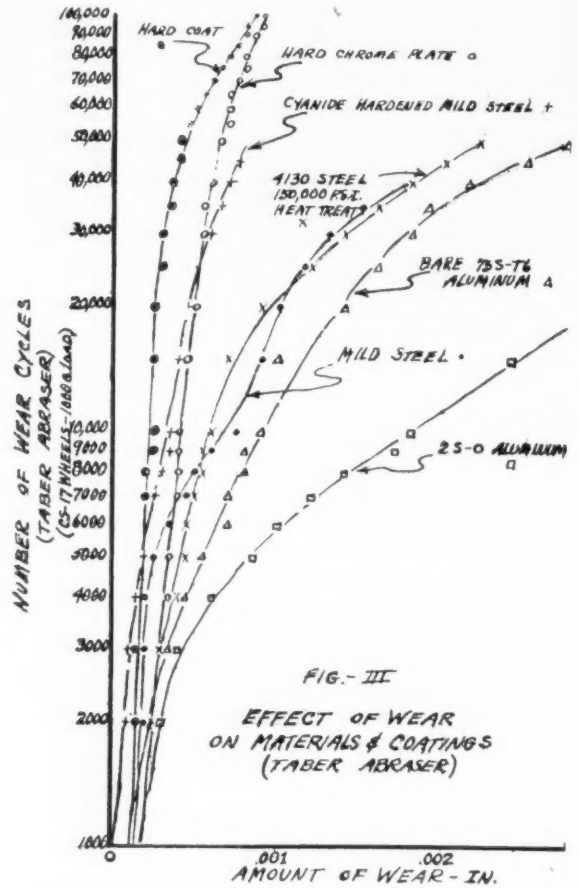
Ankle joint parts for artificial legs. Wear of these parts due to sand and dust abrasion is minimized by the new hard coating.

wrenches, exemplify the weight and cost savings through aeronautical uses of MHC.

Fields outside the aviation industry, of course, provide a great many additional applications for the coating. A sample lot of 5,000 leg braces of the type used by disabled veterans recently passed a series of laboratory tests for wear resistance, after hard-coating by the MHC process. Sand and abrasive dust particles to which the hinges are exposed cause rapid wear, and have occasioned a high percentage of failures to unprocessed aluminum ankle joints. There are nearly 10,000,000 such braces in use today, in this country.

Surface Preparation Prior To Hard Coating

Smooth surfaces such as those produced by rolling, forging, grinding, or machining, will produce the best



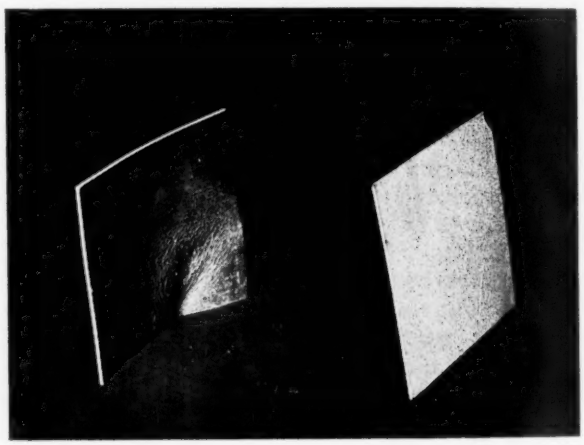
Comparison of the new hard coating with other hard surfaced materials shows its advantages in resisting wear.

abrasion resistant coatings. However, rough surfaces, such as those obtained with castings sand or grit blasted may be coated. The sand cast, grit blasted, forged, and rolled surfaces may contain small foreign particles imbedded in their surfaces that will lead to minute imperfections in the hard coating. Hard coatings should be applied as a final operation after all machining, grinding, filing, drilling, and related operations are completed.

Surface smoothness, in general, is closely maintained in the processing. Rolled 75S-T6 sheet samples, for example, having a micro inch finish of 4RMS showed a 16RMS finish after application of a .002" thick coating. When specific areas only of parts are to be hard-coated, and the rest of the part anodized or left untreated, areas that are not to have the MHC finish are masked off. The process offers exceptional throwing power, so that uniform coatings may be applied to irregular shapes and recessed areas.

Treatment Procedure

The Martin finish is applied to aluminum and aluminum alloys containing less than 5% copper, either in the wrought or cast form, by an electrochemical



Heat resistance is demonstrated by uncoated panel (left) and coated panel (right) exposed to a Bunsen flame at 1800°F. for 1 minute.

process which create a non-metallic, file-hard, highly heat-refractive surface, strongly bonded to the base metal. See Table I for a list of alloys that can be treated.

Up to the present time the Martin Co. has not disclosed the actual composition of the bath nor the exact type of coating which is produced. However, they have disclosed that conventional plating equipment and techniques are used. At present the process is not patented.

Special application often dictates the anodizing of certain areas of a part unexposed to wear, such as areas where fittings are rivetted to structures, for standard corrosion protection. When selective coating is desired, and the non-MHC areas are to be anodized, the whole part is usually anodized first, then masked for selective hard-coating.

Heat Resistance

With respect to the coating's thermal stability, due to a difference in coefficients of expansion between the base aluminum alloy and the hard finish, checking of

Table I

Alloys That May Be Coated

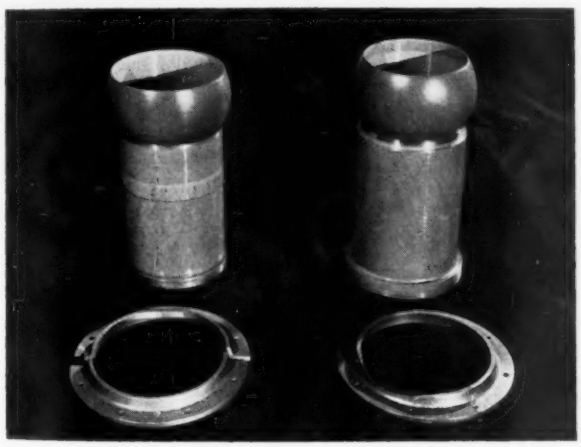
The order of preference for resistance to abrasive wear is as follows:

*Wrought Products**	*Cast Products**
1. 61S	1. 645
2. 75S Alclad	2. 220
3. 75S	3. 355
4. 24S Alclad	4. 356
5. 14S Alclad	5. 195
6. 52S	
7. 2S	
8. 24S	
9. 14S	

*Note:—Alloys other than the ones listed have not been treated.

the MHC film will occur when temperatures exceed 200°F. The coating shows no tendency to spall, however, and the checking does not affect its corrosion resistance. Martin-conducted tests have revealed that 24ST aluminum sheet with a .002" surface of MHC will stand up successfully for one minute to an 1800°F. Bunsen burner flame, whereas uncoated sheeting begins to blister at the end of 15 seconds and shows pronounced warping.

MHC-processed surfaces also afford a definite margin of heat-insulating protection to the base aluminum, when exposed for short periods to very high temperatures.



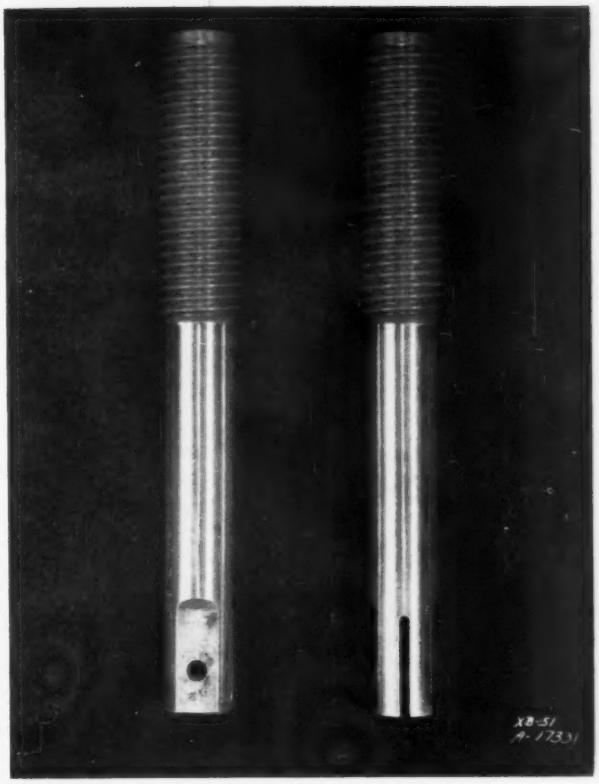
Ball and socket assemblies made of aluminum were hard coated to increase wear resistance.

Corrosion Resistance

The coating provides excellent resistance to atmospheric and salt water corrosion, as is evidenced by test panels with a .002" MHC film which have shown very little corrosion after 14 months of continuous exposure. The coating is said to be far superior to anodized coatings in this respect. The coating forms a good base for subsequent paint finishes, which makes it possible to treat the entire piece even when certain areas only are wanted with the hard coating and the rest of the part painted. Though proof against most common chemicals, the finish is attacked by strong acids and alkalies.

Miscellaneous Properties of the Coating

MHC finishes range in color from light to dark gray — depending on the alloy and the coating thickness.



MHC coating on the threads of these aluminum jack screws prevents seizures. Coating is approx. .0008" thick.

As for electrical resistance, MHC film is a nonconductor and serves as good insulator. Standard

Table II

Effect Of Coating On Dimensional Tolerances

Coated surfaces exhibit a definite amount of growth which will be proportional to the amount of film applied. The amount of growth as compared to film thicknesses is as follows:

Film Thickness	*Amount of Growth*
.0004	.00035
.0008	.00075
.0020*	.0011*
.0044	.0015

*Standard coating thickness.

(*Concluded on page 74*)

Aluminum gear train hard-coated for elimination of backlash. Slight dimensional growth during processing saved scrapping of undersize components.

The Dressing, Heading and Care of Polishing Wheels

By A. M. Brown, *Divine Brothers Co., Utica, N. Y.*

THE high production rates attained in modern metalworking plants are the result of carefully planned tooling, and are maintained for long periods only as a result of good tool maintenance. The proper care and maintenance of polishing wheels will go far to insure good results in their use, and will make wheels produce far more pieces per head than will follow from a haphazard handling. Proper wheel handling will also pay dividends in better finish and in increased wheel life. A polishing wheel taken off the line is ready to run again only after dressing, heading, drying, cracking up and balancing. These operations are each simple, and capable of standardization in any polishing room.

Dressing

The purpose served by dressing a polishing wheel after it has been used is two-fold: first, to provide a firm base for the subsequent reheading by removing the worn abrasive head; second, to restore perfect roundness and smoothness of the face of the polishing wheel.

The practice, common in some plants, of reheading wheels without dressing serves only to make the abrasive head thicker; it aggravates the unbalance of the wheel, makes the face even more bumpy than it was before, and above all, destroys any flexibility which might have been built into the wheel by the maker. Reheading without dressing eventually makes the head

Mr. Brown has been with Divine since 1937 in research and development work. He is a graduate of Union College.

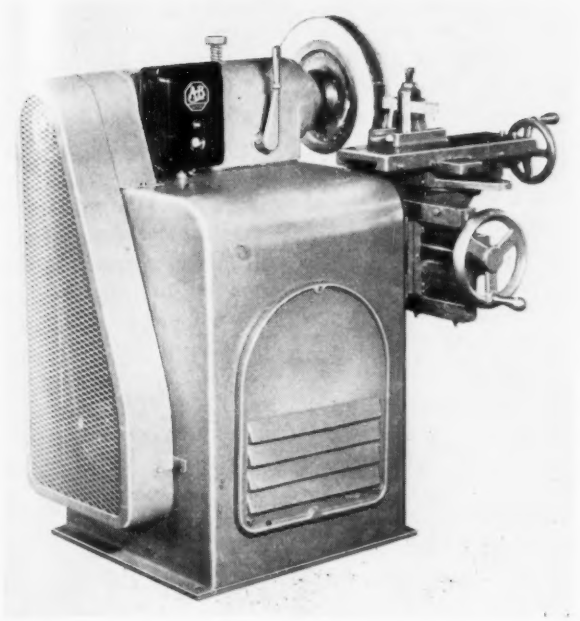


Figure 1. A modern wheel dressing machine. Note that wheel revolves in regular operating direction during dressing.

of the wheel so thick that it breaks out of the face in large pieces, dangerous to the operator, and takes the wheel out of service.

In many plants, it is common practice to dress a polishing wheel while it is on the spindle of the lathe or jack on which it is used. While this can be done with some degree of satisfaction by experienced operators, there is no assurance that the wheel will be round after dressing, and the practice — even if done well — takes the polishing lathe out of production during the time the wheel is being dressed.

The one best method of dressing wheels 6 inches in diameter and over in preparation for reheading is to use a modern wheel dressing machine especially built for the purpose. A typical machine consists of a motor driven arbor with nut and flanges, with infeed and cross-feed slides for the movement of the tool, together with a tool post and dressing tool.

Machine dressed wheels are perfectly round; the face may be restored to the original contour without difficulty, and the wheel may be dressed many times before disturbing the sizing coat. Wheels are commonly dressed at the same speed at which they are operated, and it is important that the direction of rotation of the wheel during use and dressing be the same. If the wheel is not marked by the maker, it should be marked with an arrow, showing the direction of rotation in which the wheel is to be run.

Unless the arbor hole of the polishing wheel is equipped with a metal hub or bushing, the hole will gradually become oversize and out of round, and it will be impossible to make the wheel run true, either on the wheel dressing machine arbor or on the polishing arbor. Polishing wheels, to be maintained in first class condition, must have a metal hub or bushing to insure dimensional stability of the arbor hole.

The dressing tool most commonly used consists of an abrasive brick, about 1" square in cross section, made of silicon carbide. These sticks are available in many grain sizes, and it is recommended that a stick with a grain size about three numbers coarser than the grain on the wheel be used for maximum speed in head removal. An even better tool is a diamond-impregated Carboloy dressing tip #3C, or a diamond nib such as is used in dressing and truing solid grinding wheels. The dressing tool should bear against the wheel at the level of the center of the wheel spindle.

After the wheel has been mounted on the spindle and the machine started, the dressing is quickly accomplished by advancing the tool to the wheel face and making two or three light cuts across the face of the wheel. Inspection will reveal whether or not the process should be continued to obtain a perfectly smooth face. It is not necessary, when the wheel is to be reheaded with the same grain size, to remove all the abrasive head, nor is it necessary or desirable to remove the size coat unless the wheel is to be reheaded with a grain size finer than the one previously used.

It is convenient, while the wheel is still on the wheel dressing machine, to clean the sides of the wheel with a wheel cleaning brush, and to remove with an abrasive brick held in the hand any glue and grain which has spilled over the face of the wheel and remains on the sides. Lumps of glue and grain on the side of the wheel contribute to unbalance, and should be removed.

When very soft wheels (such as hand-sewed wheels made from buff sections not glued to the face) are to be dressed, it is sometimes desirable to support them with side plates about $\frac{1}{2}$" less in diameter than the wheel being dressed. The side plates may be of steel plate $\frac{1}{4}$" or $\frac{1}{8}$" thick, but plywood side plates may be substituted. The use of side plates speeds up the dressing operation.

Sizing

When the wheel has been properly dressed, it is then up to the man who is doing the heading to determine whether or not the wheel should be given a size coat before the application of glue and grain. The size coat should be prepared using a 20% by weight mixture of glue with water and brought to the proper temperature — 143° Farenheit. New wheels should always be given one coat of sizing before being headed, and any wheel

Figure 2. Thermostatically controlled glue heating cabinet. A separate glue pot for each size grain prevents wild grains and saves much unnecessary work.

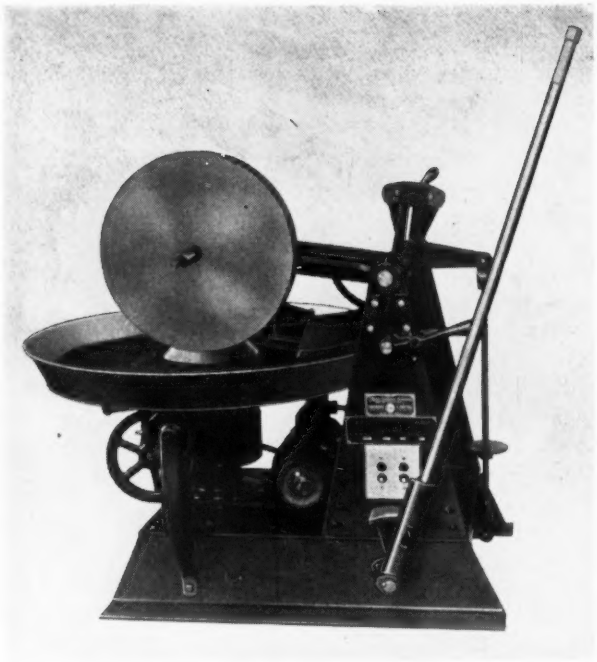


Figure 3. Machine for heading polishing wheels. Grain trough is heated.

which has had the size coat broken through so that the fabric cushion is exposed should be re-sized. The size coat keeps the grain from penetrating into the fabric, provides the strong base for the subsequent heading coat, and also acts as a protective layer against the penetration of grease or oil lubricant into the cushion of the wheel. A bond should not be expected to adhere to any wheel into which oil or grease has penetrated below the size coat. When a wheel becomes oil or grease soaked, it should be dressed down to the fabric, the wheel turned slowly in a pan of non-flammable solvent, and the wheel placed on a spindle and spun until dry. This operation may have to be repeated two or three times to remove all the grease or oil. After this is done, the wheel may be re-sized and re-used with satisfaction.

The wheel should be sized with a suitable brush, and turned by the operator so that the brushing action will make the fabric ends lie down *against the direction of the rotation arrow*. After sizing, the wheel should be dried for 8 hours, if sized with hot glue, before further treatment. When wheels are to be headed with fine grit, it is productive of a smoother head if the wheel is placed, after sizing and drying, on the spindle of the wheel dressing machine and the size coat given a very light sanding with No. 1 or No. 1½ flint sandpaper.

From this point on, the steps of the heading operation are performed with almost equal satisfaction, whether the wheel be headed on a machine or by hand. Machine headed wheels, however, because of the uniformity from wheel to wheel, often out-produce hand-headed wheels.

Rolled Head

The equipment needed for heading wheels by hand consists of an abrasive trough to hold the grain, and a wood arbor to slip into the arbor hole of the wheel. The operator applies the hot glue or other bond in an even layer, brushing it on rapidly, then inserts the arbor through the arbor hole, and rolls the wheel in an abrasive trough. A great amount of pressure or "pounding" of the wheel in the grain is not desirable, since the weight of the wheel will impress a sufficient amount of abrasive into the glue bond and provide a solid, uniform head. Excessive pressure will cause the face of the wheel to spread, and in the case of very soft wheels, drive the abrasive down between the sections of which the wheel is constructed, leaving lumps on the face of the wheel which are extremely difficult to remove later. It is to be remarked that the grain and the wheels should, whenever possible, be brought to a temperature of about 85°F. so that the glue will not be chilled. When this is not done, many operators increase the temperature of the glue to 160° or 165°. When glue is used immediately after melting, this is not particularly harmful, but heating glue for a long period reduces its strength; in any case, it is not necessary if the wheels and grain are properly warmed, to use glue at more than 140°F.

The wheel having been given a proper head, the operator is well repaid at this point to remove excess grain and glue from the sides of the wheel and the edges with a scraper or kitchen knife. After this, the wheel should be placed on a wheel rack to dry for two to three hours prior to the application of the next coat.

In plants where a large number of wheels are to be re-headed every day, and even in plants where there are only five or six polishers, it is an economy to employ a wheel heading machine. The wheel heading machine comprises a driven pan containing abrasive grain, a scraper to level the grain, and a live spindle to carry the wheel. The live spindle can be raised or lowered by means of a lever so that the wheel can come into contact with the abrasive grain.

Wheels are coated with glue in exactly the same manner as if they are to be headed by hand, but immediately after glueing, the wheels are slipped on the spindle of the wheel heading machine and lowered into contact with the abrasive. Two or three turns of the wheel are sufficient to provide a firm, continuous coat, and excessive pressure is unnecessary. It is much easier to operate a wheel heading machine than it is to roll the wheels by hand in the abrasive, particularly if the wheels are of considerable size. The wheel heading machine is provided with a grain heater to minimize the chilling effect of the application of the cold grain against the glue. When cold abrasive suddenly comes into contact with hot glue, the glue solution does not wet the grain and grip it firmly, but rather

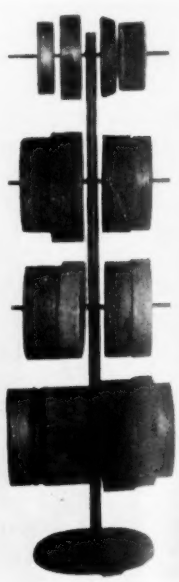


Figure 4. A convenient storing rack for finished wheels.

(Photo Courtesy of the Norton Co.)

holds it loosely as would a pebble be held were it impressed into a piece of putty.

Glue develops its maximum strength through long drying.[1] Drying is best done in a room with natural ventilation, and it has been found that temperatures below 90° are most satisfactory. If air-conditioned atmosphere is available, drying should be done with a wet bulb depression of from 10° to 13°F. The wheels should be placed on racks so that there will be plenty of air circulation between them; the rack shown in Figure IV is inexpensive, portable and extremely handy.

Extremely soft wheels may tend to open slightly at the face when drying; this is easily prevented by drying wheels on their sides, placing a sheet of waxed paper over the wheel and on this, a plywood board, building up the pile with wheels, and placing a 15 to 20 lb. weight on the top of the stack. While this does slow down the drying appreciably, the wheels will not warp out of shape, nor will the face spread.

Paste Head

Many operations employing abrasive grain sizes of 150 or finer, many wheels used in the cutlery trade, as well as polishing rolls, are headed by the paste head, or paddle head method. Paste heads can be built up to considerable thickness, and are particularly suited for finishing wheels using grain numbers 320 and finer. The preparation of a paste head is essentially simple. The glue mixture is first prepared according to the grain size to be used. To make a paste head, *warm* abrasive grain is added to the glue mixture, the whole being stirred constantly until about 35% by volume of the mixture is abrasive grain. This mixture may then be readily applied to the wheel with a glue brush, spatula, or paddle; most uniform results are obtained by using a brush. After one coat of paste head has been applied, and the wheel allowed to dry for ½ hour, subsequent heads may be applied, allowing an interval of approximately 30 to 40 minutes between each succeeding coat. There is a point which occurs a few minutes after setting at which it is possible to level out ridges by scraping the wheel to produce a very smooth head. This point occurs when the head loses its glaze, and can easily be ascertained by the operator.

Paste head wheels require an even longer time to dry than wheels which have been given a rolled head. Putting a wheel into production before its head has obtained maximum strength is false economy, since the production of the wheel will be decreased, and the wheel will have to be re-headed earlier.

There are three more operations which should be done before putting wheels into production after they are properly dry; these are the finer points of practice which mean the difference between wheels which work to perfection, and wheels which work just reasonably well. These are: truing, for paste headed wheels; cracking the head, and balancing.

Cracking the Wheel

After a wheel has dried there will often be cracks across the face. This is thought by some to be an indication of a defective wheel, but this is not the case. All polishing wheels are more or less flexible, and there is shrinkage of the glue during the drying, so it is to be expected that cracks will appear at the face. In order to restore the density of the wheel, close up the cracks, and give the fabric cushion a chance to flex, it is necessary to "crack" the wheel head. This is best done with the ball end of a 4 ounce ballpeen hammer, giving the wheel very light taps. Lacking a light hammer, a 10" length of ⅜" round bar stock may be used. The wheel should be placed on a firm surface and given light blows, with the rod inclined about 45° to the axis of the arbor hole. Repeated blows should form an "X" pattern on the face of the wheel. It is most undesirable to *beat* the wheel, since this will deform it, and knock off the abrasive. Rolled head wheels can now be balanced and used. Wheels which have been given a paste head may be readily trued by placing on the wheel dressing machine and giving them a very light dressing, just enough to even the face of the wheel. Since paste-headed wheels are usually headed with fine grains for semi-finished surfaces, the truing or dressing operation brings the wheel to the operator with a smooth face, one which does not need to be worn down in order to reach a true smooth surface. After the light dressing operation, the head of the wheel may be given additional cracking if any large cracks remain unclosed.

Balancing

With one more operation the wheel is ready to use. This operation is balancing, and though it is as important as any, it is the one most frequently neglected. Balancing may be done in various ways, using weights screwed to the side of the wheel if balancing tubes are not installed. It cannot be too strongly emphasized, that unless the wheel has a metal bushing for support of the arbor hole, the care with which the preceding operations have been performed will be entirely negated, since the wheel will not run true on the spindle and will hop and bump, despite all efforts to balance it. Compress wheels, leather covered wheels, and many cloth wheels are provided with balancing tubes, and with these 5/16 lead wire is employed to bring the wheel rapidly into perfect balance. Wheel makers will, if the user insists, incorporate balancing tubes.

The economies of use of properly headed wheels have been amply demonstrated; firms have commonly experienced increases of 300% of the number of pieces produced per heading per wheel, simply by following good heading practice. There is nothing akin to black magic in heading polishing wheels. All that is necessary is care, consistency in following procedure, and cleanliness in the department.

Polishing wheels are valuable tools and should be handled with care. Experience has shown that the best wheel heads are produced at the lowest cost per head when one man (or if the plant is large enough, two or more men) does all the heading of wheels. It is simple enough to identify each operator's wheels if the operators must have their own wheels set. When dressing and heading and balancing are done in a control department under competent supervision, there is no excuse for improperly headed wheels, and the polishers do not lose productive time away from the lathe. Proper wheel room installation has paid for itself in increased satisfaction, finish, and cost in under six months.

Reference

(1) *The Use and Treatment of Glue for Polishing.*—B. H. Divine.

Additive Compounds in Electroplating Baths—Part III

By Marvin Rubinstein

In Part II of this series, the author discussed the theory of operation of brighteners in plating baths. He now continues by describing the mechanics of operation of wetting agents, addition salts, and sequestering agents.—Ed.

UNLIKE addition agents, the actual mechanics of whose use is only postulated, the manner in which wetting agents work is a matter of scientific knowledge, worked out in both theory and practice. In discussing their use in the plating industries, two things must be kept in mind. First, wetting agents are only members of a larger group of compounds called surface active materials, including emulsifiers, detergents, spreading agents, dispersing agents, penetrating agents, foaming and anti foaming agents. The classification of the agent depends on its primary function (controlled by its structure) and principal use, but each member exhibits the functions of at least some of the other members to some degree. Secondly, in order to understand the mechanism of wetting agents, one must be familiar with the terms "wetting", "cohesion", "adhesion", and "surface tension."

When a chemically clean piece of steel is dipped into water and then withdrawn, it comes out "wet." That is to say: water is still clinging to the metal. If this action is repeated using mercury instead of water, the steel comes out of the mercury as dry as it went in. All of the mercury quickly drains off the steel as it is withdrawn. What causes this difference? Why will some liquids wet a metal easily, some with difficulty, and some not at all? Just how does this property of wetting effect plating?

Mechanics of Wetting

Cohesion and Adhesion

The steel, the water, and the mercury in the above example are all composed of molecules of matter, each substance being made up of molecules peculiar to itself and different from that of other materials. The molecules in the water, as an example, all have an attraction for each other. This property — the attraction of molecules of the *same* kind for each other — is known as *cohesion*. Cohesive properties are shown also by the molecules of the steel and the mercury.

There is another property of molecules known as *adhesion*. This is the attraction that molecules of *different* substances have for each other. Thus, water molecules and steel molecules have adhesive properties with respect to each other. Water tends to adhere to steel. With some substances, the cohesive properties are greater than the adhesive properties. This is true of mercury in respect to steel. The molecules of mercury have greater cohesion with each other than they have adhesion for steel. As a result, when steel is dipped in mercury, none of the mercury will adhere to or "wet" it. Water, on the other hand, has greater adhesive properties with respect to steel than it has cohesive properties. Consequently, it will "wet" the steel, the steel having more of an attraction for the water clinging to it than the main body of water has.

The importance of these properties in the plating operation can partially be shown by repeating the above experiment with a sheet of steel that has previously been coated with oil. The oil greatly decreases the adherence of the water to the steel; the plate comes out of the water either dry or with just a few droplets clinging to it. Repeating the procedure with a steel plate that has a heavy scale will give similar results. It can readily be seen that for effective cleaning, pickling, and plating operations the solution must make good contact with, i.e. thoroughly wet the work.

Surface Tension

Chief deterrent to ease in wetting is a property of liquids known as surface tension. This may be described as the tendency of a liquid, solid, or gas at an interface (with another liquid, solid, or gas) to "pull in on itself" and form a surface membrane that is in tension. The reason for this is obvious. A molecule of water at the center of a body of water is acted upon in all directions by the cohesive forces of surrounding molecules. Molecules at the surface, (water-air interface) however, have only cohesive forces pulling them downward. The adhesive force between water and air, being extremely weak, does not prevent this. Thus, the surface molecules of water are in appreciable tension. Natural manifestations of surface tension are many and varied. Raindrops assume their shape as a compromise between surface tension, which tends to make them spherical, and gravity forces which tend to make them larger at the base. A razor blade or a needle, which would ordinarily sink in water, will float at the surface if carefully placed there so as not to destroy the surface tension. In a plating bath, surface tension tends to keep both the anode and the work from making intimate contact with the solution.

Wetting Agents

Wetting agents are almost invariably composed of two parts. One, a long water-insoluble hydrocarbon "chain," is called the hydrophobic or "water hating" portion. (It is also sometimes known as lipophilic or "oil loving.) To this is attached a highly water-soluble ionic group, known as hydrophilic or "water loving." In most cases the hydrophilic group is a salt residue such as sodium sulfate or sodium sulfonate. When wetting agents are added to a plating or cleaning bath, they align themselves at the interfaces — the sides of the tank, the surface, the anodes, and the work. In all these positions, the molecules are so oriented that the hydrophilic portion (water loving) remains dissolved

in the water, while the hydrophobic portion (water hating) juts out into the air or makes contact with the metal surface of the anodes and work (and, less important, the sides of the tank). The wetting agent molecules in this position tend to act as a bond, somewhat in the way that glue binds a piece of wood to a piece of metal. The glue has large adhesive properties for both materials. Similarly, the water loving portion of the wetting agent has great attraction for the solution; the water hating portion has more of an attraction for the work and anodes than has the solution itself. Since the two portions form an integral whole, they tend to pull the metal and solution closer together, providing better wetting. Surface tension is reduced by interfering with cohesion at the surface, while adhesive properties are increased.

Just what effect does this have on the plating? First of all, the improved wetting of the work by the solution decreases local resistance to the flow of current at the interface. It does this directly by decreasing the electrical energy needed to overcome the resistance of the high surface tension itself. Indirectly, it decreases surface resistance by dissipating hydrogen bubbles and dirt particles that are apt to cling to the cathode, particularly in baths not operating at 100% efficiency. In such baths, dirt and hydrogen particles are held in place at the cathode by an equilibrium of forces between the hydrostatic pressure of the solution and its surface tension. When the surface tension is reduced by a wetting agent, the hydrostatic pressure (in this case its free of buoyancy) is then sufficient to cause the hydrogen bubbles to rise. Dirt particles will either rise or precipitate, depending on their size and weight. In any case, polarization is reduced, resulting in less resistance at the cathode to the flow of current. Both of these mechanisms allow the plater to use higher currents without the danger of "burning." Thus the use of wetting agents gives faster plating and helps prevent hydrogen and dirt pitting. At the anode, polarization is similarly avoided.

Surface tension is measured in terms of an energy or force factor — dynes per centimeter. Distilled water has a surface tension of 72 dynes per centimeter. A really good wetting agent will reduce the surface tension of a solution to from 30 to 32 dynes per centimeter, in concentrations of not more than $\frac{1}{2}$ oz./gal. Hydrogen pitting will be eliminated at below 60 dynes per centimeter. However all the other advantages of wetting agents will not be achieved until the figure falls below 38 dynes per centimeter. Of course, a good wetting agent should have other characteristics, such as stability under varying conditions of temperature and pH.

Wetting Agents In Cleaning

This article is less concerned with cleaning solutions than with plating baths. However, a description of the functions of wetting agents in cleaning and pickling baths will provide information on subsidiary functions of the wetting agent in the plating bath.

In the cleaning bath, as in the plating solution, surface tension is decreased, allowing particles of dirt to either rise or precipitate. Once the particles have come free from the cathode, however, other properties of surface active agents go into action; the properties of deflocculation and detergency. The wetting agent molecules orient themselves around each dirt particle, the oil-loving portion directed toward the center of the particle and the water-loving portion headed outward into the solution. This orientation causes the dirt particles to repel each other, prevents agglutination and re-deposition on the cathode. Where scale or heavy dirt exists on the cathode, the penetrating properties of the wetting agent are brought into play. This provides for greater penetration of the dirt or scale by the solution with subsequent better cleaning. All of these secondary properties so necessary to cleaning become helpful in the plating operation. Thus, the auxiliary cleaning provided in the plating bath helps improve the final finish.

Several miscellaneous functions are also performed by wetting agents. In a recent article on Fluid Mechanics, *Kushner* demonstrated that wetting agents decrease the size of hydrogen bubbles released at the cathode, thereby increasing their number in direct proportion. Using the formula $P = 2t/r$ for the blowing of gas bubbles into a fluid from a definite sized opening, he applied it to the generation of bubbles at the cathode. In this formula, P equals the difference between the inside and outside pressures on the bubble, t equals the surface tension, and r equals the radius of the bubble. If the pressure difference can be assumed to be constant, it is easily seen that the radii of the bubbles will vary with the surface tension. Decreasing the surface tension with a wetting agent provides for smaller bubbles. Since the mass of hydrogen evolved remains constant, smaller bubbles mean more bubbles. And more bubbles mean an increase of scrubbing action at the cathode for better cleaning, less pitting since smaller bubbles rise more easily, and possibly even an increase in agitation and film renewal at the cathode with consequent allowance for higher current densities. It is interesting to note the application of this principal to the reduction of chromic acid spray in chromium plating. Smaller bubbles have less free energy and burst much less vociferously when they hit the surface of the solution. Thus, with the addition of special wetting agents to the chromium plating bath, considerably less spray results and much less chromic acid is wasted up the vent, not to mention the increased comfort of the operator.

Wetting agents decrease dragout. By decreasing the surface tension of plating solutions, their free flowing properties are enhanced. Racks being removed from plating baths will lose a greater weight of solution clinging to them, with consequent reduction of dragout and its accompanying cost. Wetting agents also sometimes act as brighteners. In some cases, they are directly adsorbed or plated out at the cathode, reducing the crystal size. In others, they may effect other brighteners present in the solution by increasing their adhesion either to the cathode as a whole or to specifically oriented crystal faces at the cathode. In any case, where wetting agents are properly used, they give better plating.

Classification of Wetting Agents

When added to an aqueous solution, most wetting agents tend to ionize, i.e., split apart into positively and

negatively charged particles, or ions. Those most commonly used in plating solutions, the *anionics*, have a long-chain hydrophobic (water hating) portion which becomes *negatively* charged during the ionization. Thus, it tends to be carried towards the anode during plating and cleaning. For this type, the positively charged portion, or *cation*, is usually a sodium or potassium ion. It can easily be seen that this tendency to migrate away from the cathode is advantageous in electrocleaning, since it tends to prevent the formation of films at the cathode, helps carry dirt away. In the plating operation, however, this advantage is partially counteracted by the resulting decrease of concentration of wetting agent at the cathode.

In a second group of wetting agents, known as the *cationics*, the hydrophobic (water hating) portion becomes positively charged and is drawn to the cathode. (The anion, here, is often a chloride or bromide ion.) The big disadvantage of this is that the positive charge causes the long chain to react with soaps and certain saponifiable oils and dirts, forming films and scums. These films may deposit on the work and cause trouble. However, in reverse-current cleaners, exactly the opposite is true, and cationics are often more valuable than anionics. Cationics have one other advantage, in that they have less of a tendency towards salt formation with heavy metals, a difficulty sometimes encountered with certain anionics. The third type of wetting agents do not ionize in solution. Thus, they are known as *non-ionics*. They do not migrate towards either electrode, do not react with either soaps, soils, heavy metal salts, or the alkaline earths found in hard water. Non-ionic wetting agents are relatively little used in present day electroplating, but only because they are so new to the field. The double advantage of their electrical neutrality and their stability towards other chemicals is rapidly making them more and more useful and commonplace in plating solutions.

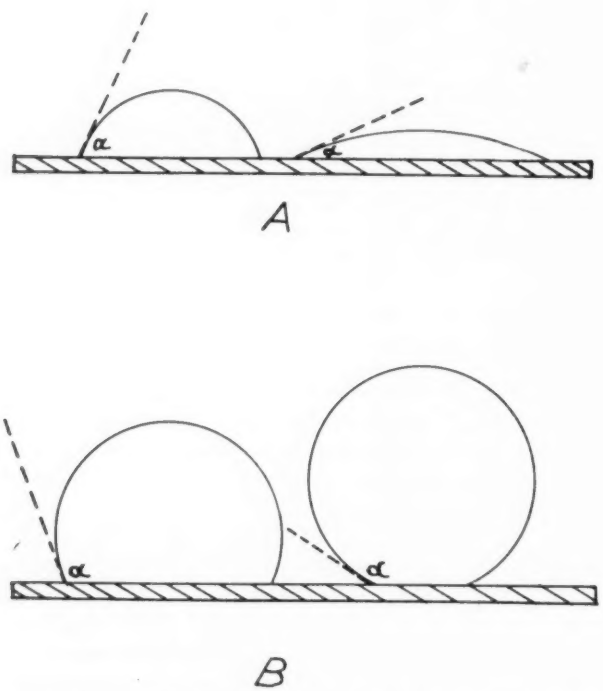


Figure 1. Theoretical representation of droplets of water on an oily metal plate. In "B" the surface tension of the solution prevents the droplets from spreading out and wetting the plate. Notice that the angle between the side of the droplet and the surface of the plate is larger than 90 degrees. In "A" a wetting agent has been added to the bath. Here, the drops spread out, wetting the surface. Angle is now less than 90 degrees. In actual practice, these droplets will not be perfect spheres, but will tend to flatten out due to their own weight.

For a more thorough description of the chemical structure of wetting agents, the reader is advised to read the section by *Dr. Donald Price* in the 1949 Metal Finishing Guidebook.

Addition Salts

As noted in Part I of this series, addition salts are added to plating baths for one of several purposes: to serve as a buffer, to provide sludge-free anode corrosion, to increase conductivity, throwing power and efficiency. Chemicals which form buffer solutions, as boric acid or nickel formate in nickel plating baths, are among the most commonly used addition salts.

Buffers

A buffer may be described as a compound or mixture capable of maintaining the pH of a solution within a very narrow range when relatively small amounts of acid or alkali are added to the solution, or when the solution becomes considerably more dilute or concentrated. With increased use of bright plating solutions, where pH control assumes great importance, buffering compounds become more and more valuable.

In a normal production line, small quantities of muriatic or sulfuric acid are often dragged into the plating bath from a previous dip or rinse. Being strong acids, these dissociate completely providing a large concentration of additional hydrogen ions.

It can be seen that a continuous cycle of hundreds and sometimes thousands of racks per day will drag large quantities of H^+ ions into the solution, causing a rapid drop in pH with subsequent difficulties in the plating operation. In another line, the impurity dragged in might be caustic soda from a previous cleaner. The hydroxyl ions neutralize the hydrogen ions in the solutions and cause a large rise in pH. Also, in all solutions, minor differences between anode and cathode efficiencies cause variations in pH. In any case, the condition is undesirable, and even thorough rinsing before going into the plating bath does not completely eliminate the problem. Buffered solutions, however, do provide an answer.

Theory of Buffer Action

Buffers usually consist of a weak acid or base, or one of its salts. Weak acids (or bases) are those which only slightly ionize in solution, i.e. dissociate only partially, yielding relatively few hydrogen (or hydroxyl) ions. Their salts, of course, dissociate completely into a positive metal ion and a negative acid radical. When acid is dragged into a buffered solution, the excess hydrogen ions react with the acid radical removing it from the solution and replacing it with molecules of the weak acid. Since this dissociates very little, the pH changes are extremely small. Where caustic is dragged in, it reacts to neutralize the weak acid, effectively removing itself from the solution without appreciable changing the pH.

As an example, acetic acid (a weak acid) and

sodium acetate are occasionally used in buffering a nickel solution. They dissociate as follows:

$$HAc \rightleftharpoons H^+ + Ac^- \text{ (slightly)}$$
$$NaAc \rightarrow Na^+ + Ac^-.$$

For the most part, the mixture provides only Na^+ ions, Ac^- ions, and HAc molecules for the solution. When muriatic acid is dragged in:

$$H^+ + Ac^- \rightarrow HAc$$

The additional HAc in the solution causes the HAc present to dissociate slightly, creating a few (but only a few) additional hydrogen ions. When caustic soda is dragged in:

$$(OH)^- + HAc \rightarrow Ac^- + H_2O.$$

In either case, there is no appreciable increase or decrease of H^+ ions, no radical change in pH.

It is interesting to note that certain single chemicals act as buffers by themselves. They achieve this by forming in solution both the weak acid (or base) and its salt. A case in point is sodium bicarbonate. Sodium bicarbonate ($NaHCO_3$) is the salt of a weak acid, carbonic acid (H_2CO_3). In solution, the salt dissociates thus:

$$NaHCO_3 \rightarrow Na^+ + HCO_3^-$$

forming the bicarbonate ion, which is itself a weak acid, slightly dissociating as follows:

$$HCO_3^- \rightleftharpoons H^+ + CO_3^{--}.$$

Thus, when excess hydrogen ions are dragged into the solution, they react with the bicarbonate ion to form carbonic acid; when hydroxyl ions are brought into the solution, they also react with the bicarbonate ion, forming water and the carbonate ion.

This case is important in that it is possible that boric acid buffers a nickel solution in a similar fashion. It has been postulated that a complex nickel borate salt is formed. Such a salt of a weak tribasic acid could very well have a buffering activity similar to that described above. (Incidentally, it has been postulated that at least one complex formed is a nickel chloroborate, similar to commercially used fluoborates.)

Before leaving the field of buffer activity, it might be wise to show quantitatively the extreme value of buffers in maintaining pH. If 100 ml. of 0.1 molar muriatic acid were added to a liter of pure water, the hydrogen ion concentration would increase by a factor of 100,000. The pH would drop from 7 to about 2. Now, if the same liter of pure water were first buffered by adding 0.1 mole each of acetic acid and sodium acetate, the addition of a similar amount of muriatic acid would only increase the hydrogen ion concentration by a factor of 1.22. The pH would decrease from 4.73 to 4.65. The addition of 0.1 molar sodium hydroxide to similar solutions would decrease the hydrogen ion concentration and increase the pH proportionately. In Table I the result of adding varying amounts of acid or base to both buffered and unbuffered solutions is shown.

From this table, two things become immediately apparent. Firstly, even very small quantities of acid or base dragged into an unbuffered solution bring about extremely large changes in pH. These changes, incidentally, in a plating solution are not usually of the magnitude that they are in pure water. Salts present in the solution, e.g. nickel sulfate in the nickel bath, often offer some buffering activity. However, the pH changes are still too large for effective easily controlled plating.

Secondly, it can be seen that buffers tend to maintain the pH of a given solution at a specific value common to that buffer under given conditions. Thus, a water solution 0.1 molar in both sodium acetate and acetic acid tends to maintain a pH in the vicinity of 4.73. Changing the relative concentrations of the two buffering constituents will vary this somewhat, as will using this buffer in a nickel solution rather than in pure water. However, generally speaking, this buffer combination will maintain a pH of about 5 in a solution. Other buffer mixtures are used where other pH ranges are desired. Several examples are given below:

	pH Range
Hydrochloric Acid plus Potassium Chloride	1.0— 2.0
Acetic Acid plus Sodium Acetate	3.5— 5.5
Citric Acid plus Disodium Phosphate	2.4— 8.0
Boric Acid plus Sodium Borate	7.0— 9.1
Dibasic Sodium Phosphate plus Sodium Hydroxide	11.0—12.0

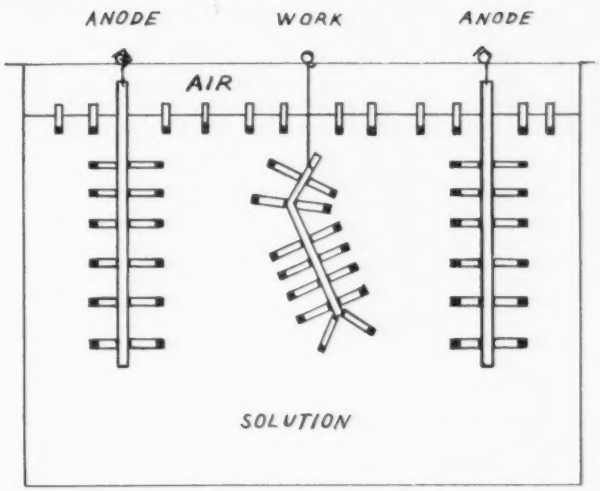


Figure II. Distribution of wetting agent molecules in a plating bath. The hydrophobic parts of the molecules will orient themselves towards the air at the surface and towards the anodes and the work. (They will also align themselves at the tank sides and bottom; this is not shown in the diagram.) The hydrophyllic parts of the molecule will be directed inwards towards the solution. In this diagram, the hydrophyllic portions are shown in black, the hydrophobic parts in white.

Table I
Effect of Buffers

ml. of 0.1 M. HCl added to 1 liter of unbuffered sol.	pH of final sol.	ml. of 0.1 M. HCl added to 1 liter of buffered sol.	pH of final sol.	ml. of 0.1 M. NaOH added to 1 liter of unbuffered sol.	pH of final sol.	ml. of 0.1 M. NaOH added to 1 liter of buffered sol.	pH of final sol.
0	7.0	0	4.73	0	7.0	0	4.73
5	3.3	5	4.73	5	10.7	5	4.74
10	3.0	10	4.72	10	11.0	10	4.74
25	2.6	25	4.71	25	11.4	25	4.76
50	2.3	50	4.69	50	11.7	50	4.78
75	2.1	75	4.67	75	11.9	75	4.80
100	2.0	100	4.65	100	12	100	4.82

There are, of course, many others. The pH at which a buffer mixture best operates is determined by the ionization constant "K" of the weak acid. Thus, from a knowledge of the ionization constant of a weak acid, and the approximate concentration of the buffering ions in solution, the buffering range of the mixture can be calculated. It is interesting to note also that a buffered solution is independent of dilution. In an unbuffered solution, dilution will tend to shift the pH towards 7, i.e. towards the pH of water.

Anode Corrosion

Another commonplace use of addition salts is in aiding sludge-free solution of the anode. Older type cast anodes are of a loosely crystaline structure — elongated along one axis — and usually have various inclusions of oxides and foreign impurities. In the plating bath, this leads to rapid but uneven dissolution of the anode. Crystal boundaries dissolve more rapidly than some individual crystals; as a result, these crystals fall off the anode and into the solution, and act as foreign particles which often show up on the cathode as roughness. Similarly, oxide slimes and particles create difficulties, while inclusions of foreign metals effect the plating adversely, particularly in bright plating baths.

Numerous steps have been taken to combat these difficulties. Let us take the nickel plating bath as an example. Anodes of a very high degree of purity have been manufactured to prevent the addition of metallic impurities to the solution. Carbon and silicon have been added as constituents of the anode. Carbon forms a slime, and silicon a "gel," on the surface of the anodes; these tend to bind undissolved crystals to the anode long enough for them to be dissolved by the solution. Finally, anodes have been rolled and annealed, forming dense, tightly packed, equi-axial crystals, resulting in anodes which dissolve steadily and evenly. However, these steps have only brought about additional problems. Nickel tends to form oxide films and become passive in sulfate baths. The purer the anodes were made, the more passive the anodes became. A similar problem arose when anodes were rolled to refine the grain structure. The denser the anode, the more passive was its surface. Depolarizers of nickel oxide added to the anode only partially alleviated this condition. Both for the carbonized anodes and the rolled, annealed anodes, a more highly corrosive medium was needed.

Thus, in most present-day nickel baths, nickel chloride is added as an addition salt primarily for the purpose of increasing anode corrosion. With carbonized anodes, the nickel chloride serves partially to equalize the dissolving action on both the crystals and the grain boundaries, partially to quickly dissolve any loose crystals being held on the anode surface by the carbon-silica binder. With rolled, annealed anodes, the nickel chloride activates the surface, keeps it active, and provides for a higher rate of anode solution at high current densities with little or no sludge formation. In both cases, included oxides are dissolved by the chloride as well.

The precise reason for the more corrosive nature of the chloride ion has not been adequately explained. It is certainly more active than the sulfate ion. Metals dipped into a solution of chloride ions tend towards solution rather than towards remaining in their solid, crystalline state. Notice their effect on stainless steel and steel plating tanks. Their activity is undoubtedly due in part to the position of chlorine in the periodic table. Another possible explanation lies in the small size of the chloride ion. It is thought that this small size enables the chloride ion to permeate the pores in any nickel oxide coating forming on the anodes and to attack the underlying metal. Sulphate ions, being larger, would be much less effective. This seems to be at least a partial explanation.

The mechanism of improving anode corrosion is often of a different nature, as in the case of Rochelle salts in cyanide copper baths. In the simple copper bath, no difficulty is encountered in anode solution until the plater attempts using high current densities. Even at high current densities, the actual rate of solution of copper ions remains high. Unfortunately, the copper ions dissolve in the anode film, and a process of diffusion must take place before they become a part of the main body of solution. As the current density increases, this rate of diffusion from the anode film to the main body of liquid remains constant, while the rate of dissolution of the anode increases. Before very long, the anode film becomes saturated with copper ions, resulting in anode polarization and subsequent decrease of current density. It is believed that the Rochelle salts serve to form a temporary complex copper tartrate ion which diffuses from the anode film much more rapidly. Thus it decreases the concentration polarization at the anode and indirectly betters the anode corrosion of the cyanide copper solution.

Increasing Conductivity

All plating solutions in common use have at least one constituent whose purpose is in part to increase conductivity. Though essentially a part of the bath, this constituent may also be considered an addition salt. Sulfuric acid in the acid copper bath and free cyanide in the cyanide copper bath are typical examples. Caustic soda in high speed copper baths is an example of an addition salt, not a part of the original bath, whose purpose is to increase conductivity.

When a current is passed through a plating solution, an equivalent amount of electrochemical activity takes place at each electrode. For a given number of electrons supplied at the cathode, an equal number is taken up at the anode. However, for the circuit to be complete, these electrons must also travel through the solution, carried by respective ions to and from the electrodes. The conductivity of a solution is a measure of the ease with which these ions travel through the solution. Upon this depends the electrical force (volts) needed to drive a given number of electrons (current) through the solution.

Conductivity depends upon the concentration of ions in a solution, the type of ions present, the viscosity of the solution, and the temperature. The use of addition salts changes or adds to the types of ions present in the solution. Why is there less resistance to the travel of certain ions in the solution? To begin with, this resistance is caused by the pull-back or "drag" effect of the other particles in the bath to the travel of ions between electrodes. Naturally, ions with smaller diameters will run into less resistance to their move-

ment. In addition, any ions in aqueous solution become solvated, i.e. they attach to themselves several molecules of water. Having to drag these water molecules with them makes for greater resistance and thus less conductivity. (Incidentally, one reason why heat increases conductivity, is that solvation becomes more difficult at higher temperatures.) Ions which do not tend towards solvation are better conductors.

Practical experience teaches that acids and bases are excellent conductors. So, in acidic solutions, the acid of the salt being used makes a good addition salt for increasing conductivity. For very basic solutions, caustic soda can be added. For baths where too much acidity or basicity is to be avoided, it will be found that chlorides are more conductive than sulfates and that ammonium salts and potassium salts are better than sodium salts. Below is given a list of 0.5 N solutions of a few commonly used plating chemicals and their conductivities at room temperature (77°F), expressed in mho/cm. A glance through it will give some clues to choosing an addition salt to increase conductivity.

Sulfuric Acid	0.108
Potassium Hydroxide	0.105
Potassium Chloride	0.058
Potassium Cyanide	0.064
Sodium Chloride	0.046
Ammonium Chloride	0.057
Copper Sulfate	0.018
Nickel Sulfate	0.019
Nickel Chloride	0.040
Silver Potassium Cyanide	0.063

Throwing Power

Addition salts are also used to increase throwing power. Here the mechanism is relatively simple to explain. When a low current is sent through a plating solution, there is a primary current distribution at the cathode, more current going to the portions nearer the edges of the work and to the parts nearest the anodes. The center parts of the work and the recessed portions get less current. As the current is increased, polarization takes place at the cathode, increasing the resistance to the flow of current. Since there will be a maximum polarization at the points where the current is highest, the greater resistance at these points will cause a shift to a secondary distribution of current. This secondary distribution provides for a larger percentage of the current going to the central and deeply recessed areas of the work, i.e. it will better the throwing power. Thus, it can be seen that any addition salt which increases cathode polarization will better the throwing power.

Where the conductivity of a solution is high, less voltage is needed to produce a given current. Therefore, for such a solution, the back voltage produced by polarization is a larger percentage of the total voltage than in a solution of low conductivity. The effects of polarization will then be greater, which means an increase in throwing power. It can be said, then, that in solutions where polarization occurs, increased conductivity means increased throwing power. And addition salts which increase the conductivity of the solution will also increase the throwing power of such solutions.

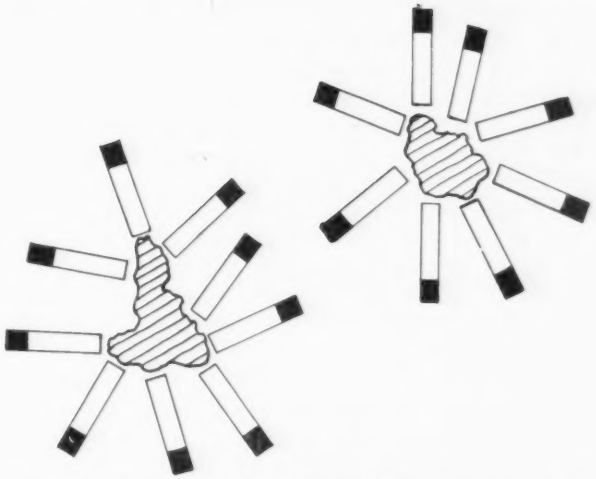


Figure III. Particles of dirt in solution become surrounded with wetting agent molecules, which prevent their coagulating or settling on the cathode. Note that the hydrophobic portions (black) of the molecules are directed towards the dirt or oil particles.

Current Efficiency

In a given plating bath, various ions exist, not only the ions of the salts used in the solution, but also hydrogen and hydroxyl ions from the slight ionization of water and ions of various impurities and of additions to the solution. Thus, in a nickel bath there are Ni^{++}, SO_4^{--}, Cl^-, H^+, and OH^- ions in addition to a few ions of impurities as Cu^{++}, Zn^{++}, and Fe^{++}. At the anode, most of the current will be used to plate out nickel, but a portion of it will be used in releasing hydrogen, in plating out the foreign cations present, and perhaps in side reduction reactions with other ions in the solution. Cathode current efficiency is defined as the percentage of the total current at the cathode being used in plating out the desired metal, in this case nickel.

Whether the metal desired, or hydrogen, or any of the impurities will plate out at the cathode depends upon several factors: the current density, the hydrogen ion concentration (pH), the relative concentration of the various cations present, the position of these cations in the electromotive series with respect to each other and to hydrogen. Thus at low current densities, where there is insufficient potential to plate out much nickel, copper impurities will plate out of a nickel bath despite their low concentration. In very low pH nickel baths, there is a tendency to evolve hydrogen, because of its high concentration at the cathode. Large quantities of hydrogen are evolved in plating chromium because chromium is so much higher in the electromotive series than hydrogen.

Metals such as copper, which are low in the electromotive series, tend to plate out more readily than metals like zinc which are high in the series. But, with normal current densities in a nickel bath containing slight copper impurities, nickel will plate preferentially because of its much higher concentration, in spite of its high and less favorable position in the electromotive series.

Now, the question occurs: How can addition salts increase cathode efficiency? There are two ways. Firstly, they can be used to decrease the concentration of undesirable cations. This may be done by retarding

the ionization of certain constituents through a common ion effect. Or, the unwanted ion can be taken out of action by precipitation, oxidation, reduction, or tying it up as an inactive complex ion. In this way, lead is precipitated from a bright cyanide zinc bath by sodium sulfide, and nascent hydrogen is oxidized by hydrogen peroxide in a nickel solution. The second and most effective method of increasing cathode current efficiency with addition salts is through the formation of complex ions with the metal being plated. The complex ion formed from a metal must be of such an electrochemical nature as to give it a more favorable position in the electromotive series than the plain metal ion itself. In this way, the metal will deposit as a complex with a higher cathode current efficiency. Rochelle salts in a cyanide copper bath performs the amazing double duty of increasing corrosion at the anode through complex formation and increasing current efficiency at the cathode through the same device.

Sequestering Agents

The actual mechanism of sequestering is not difficult to understand. A sequestering agent is actually a water-soluble ion exchange system. Used in a plating or cleaning bath, its purpose is to remove from activity heavy metal and alkaline earth ions, so that they do not impair the operation of the bath. The squestering agent achieves this by chemically converting the undesirable ion to an uncharged complex that is soluble in the solution. In this form, the undesirable ion is chemically inert — will not plate out because it has no charge, will not precipitate out as a scum or objectionable particles because it is water soluble and inactive.

In cleaning solutions, three undesirable ions often create trouble. These are Ca^{++}, Mg^{++}, and Fe^{++} which are always found in hard water. If a soap is added to a solution containing these ions a scummy precipitant will result. Now, if an inorganic sequestering agent such as sodium hexametaphosphate is also added to the solution, the precipitate will redissolve. If added before the soap is added, the precipitate will never form. The calcium, for example, will be tied up in a sequestered form.

In the plating bath, similar reactions occur. Calcium and magnesium which cause roughness in bright copper plating can easily be sequestered. The organic sequestrants can also be used to sequester heavy metals such as lead when it is undesirable in solution. It will also work for other metals, but the larger the atomic weight of the metal, the better the sequestering power. Organic sequestering agents have additional advantages in that they will partially reduce the surface tension (to about 50 dynes/cm.), and they can be used in larger quantities as addition salts (as in the Brintzinger baths described earlier in this series). Their disadvantage is that they are not successful in acid solutions. Sequestering agents, not extensively used in the plating field today, have a very promising future.

(*To be continued*)

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HARD FINISH FOR ALUMINUM

(*Concluded from page* 63)

anodic films show a voltage breakdown of about 340 volts — against a range of 500 to 3700 volts for the hard coatings.

A definite coefficient of sliding, or static friction, has not as yet been determined — but preliminary tests indicate that MHC film has a lower frictional index than that of untreated metal. Sliding wear tests involving various combinations of hard coated and bare metal surfaces with lubricants indicate that maximum resistance to wear is obtainable by use of MHC film with a lubricant of molybdenum sulfide or graphite grease.

Dimensional Control

Coating thicknesses range from .0001 to .006 inches — abrasion resistant uses, as a rule, calling for .002 inches. The thickness is governed by the length of time the part remains in the electrochemical bath. The processing results in a coating of aluminum compound integral with the base metal, which through its participation in the reaction is reduced by varying percentages of the coating's thickness, according to that thickness.

Compensating for this, by way of an example, parts to be MHC-processed to the standard .002-inch thickness are normally made up to a minus tolerance representing about one half the thickness of the proposed finish. On the other hand, advantage can readily be taken of the dimensional growth of parts under MHC processing, in the case represented by worn or undersize gears which, when given a light coating, no longer tend to backlash. This permits salvage of gears that would otherwise have to be replaced. Table II shows the affect of coating thickness on dimensions of a treated part.

Costs

The MHC hard coating process is relatively expensive, as currently applied on a purely experimental basis in the Martin engineering laboratory. On a production scale, it would probably compare in cost with such operations as the heat-treating of steel. It may be noted, in any case, that the new process would be considerably cheaper than that of hard chrome plating.

Development of Metal Cleaners Using Radioisotopic Evaluation Methods

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METAL cleaning compositions may be of many types and kinds but those of specific interest to this presentation are those of an alkaline nature containing effective surface active agents to improve the general cleansing characteristics.

The laboratory evaluation of cleaning compositions in most instances depends upon the use of a standardized soiling composition which is applied to a selected metal surface, and from which it is wholely or partially removed under controlled conditions. Until recently the evaluation of degree of cleanliness had been through observation of water break, the fluorescent dye technique,[1] or more recently, a semi-quantitative method involving the spraying of droplets of water onto the cleaned metal surfaces.[2]

It is quite possible to clean metal surfaces so that no apparent difficulty is encountered when the metals are further processed in baths sensitive to contaminants, as for example in electroplating. A laboratory method for evaluation of cleanliness of ferrous metals to be plated is described by *Hogaboom*[3] and consists of a dip in an acid copper sulfate solution. In this case, unless the metal is essentially soil free, the plate is either non-adherent or discontinuous, either of which is sufficient cause for rejection. Thus in many instances, metal cleaning is a matter of apparent total cleanliness since anything less can result in objectionable work.

The recently developed method for using radioisotopic tracer compounds in metal cleaning[4] is not only quantitative in nature, but is considerably more sensitive than any of the older methods as outlined above. Even though quantitative and sensitive methods are available, for most purposes the metal surface should be essentially completely free from contaminating materials which will cause subsequent processing difficulties. Consequently, beyond a certain point, measurement of remaining soil may have slight bearing upon practical operations. However, since a laboratory method should differentiate between "clean" and contaminated areas, and since partial cleansing has little significance, a technique for evaluation involving dilution of cleaning liquor must be followed to determine cleaning effectiveness. The present paper is concerned with the use of the radioactive tracer technique utilizing the dilution method to show the effectiveness of commercially available metal cleaning compositions.

Work by *Morgan and Lankler*[5] has shown that one of the most effective types of composition contains 5% alkyl benzene sodium sulfonate combined with 95% sodium metasilicate. The surface active agent provides adequate surface tension lowering, improved drainage,

Figure 1. **Each cleaner composition was evaluated by immersing soiled specimens in the above manner.**

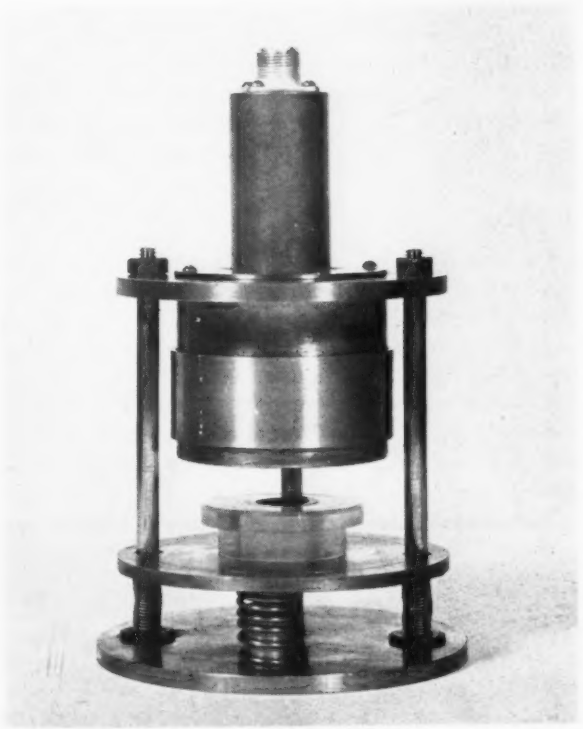

Figure 2. **A closeup of the Geiger-Muller tube, platform, and light shield. The specimen can be seen inserted in the lower plastic ring.**

is stable to water hardness, and to the conditions and soils encountered. Another class of materials widely used consists of either wood rosin (subsequently saponified) or sodium resinates which are effective in soft water and do not cause difficulty when the rinse is likewise of soft water. Naturally, such a composition is not used to best advantage where hard water is encountered or in cases where the piece being cleaned is subsequently subjected to an acid dip, since both hard water soaps and deposited rosin acids are contaminants and are objectionable.

The alkyl benzene sulfonates are effective agents for this type of work but it was believed that the use of a non-ionic type agent which did not foam excessively would perhaps prove of even greater advantage. Consequently the data developed for this paper shows comparisons of certain of these surface active agents and also compares the relative effectiveness of several alkalies in combination with a single surface active agent.

Cleaning Procedure.

The pan size is of one inch diameter with a drawn depression $\frac{1}{32}$" depth with a $\frac{1}{16}$" rim. This size was required because of the diameter of the mica window of the Geiger Müller counter tube. The pans were vapor degreased in carbon tetrachloride prior to soiling, dried under an infrared lamp and stored in a desiccator ready for use. Immediately before soiling, each pan was weighed, soiled and counted for background.

The soiling mixture used was of the following composition:

SAE No. 60 Lubricating oil (Standard Oil of Ohio)	97%
Fluorescent Green HW (Wilmot & Cassidy, Inc.)	2%
n-Undecane (C^{14} Tagged)	1%

The soil was evenly applied in 25 mg. amounts to the pans, using a glass stirring rod. Assay of these pans showed a count averaging about 50,000 per minute.

Conditions observed follow:

1. Metal:
   (a) Surface-hardened sheet steel—No. 32 gage.

Figure 3. Complete testing apparatus, showing the tube assembly and scaling apparatus.

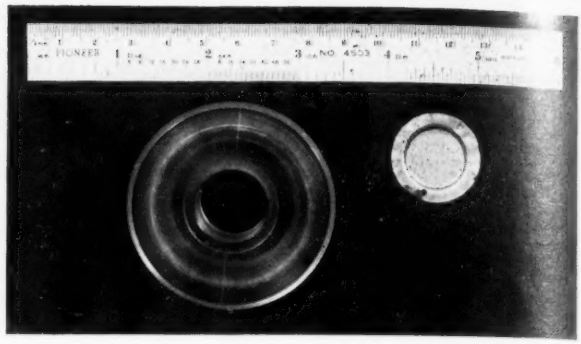

Figure 4. Showing sample pan used in the tests (right) and the plastic holder for the measuring.

2. Panel Size:
   (a) Disks, 1" diameter.
3. Solution:
   (a) Detergent — 5% Santomerse No. 1; 95% anhydrous sodium metasilicate or other, as indicated.
   (b) Concentration — either 2.5% or 5% by weight in distilled water as indicated.
   (c) Volume — 35 to 40 ml.
   (d) Temperature — Rolling boil.
   (e) Time — 5 minutes.
   (f) Agitation — see *d*.
   (See Fig. 1 for cleaning assembly.)
4. Rinsing:
   (a) Two in distilled water; one in running tap water.
   (b) Time — Six dips into each hot rinse; approximately 60 seconds in running rinse.
   (c) Temperature — Distilled water at boil; running cold tap water at tap temperature (about 50°F.).
   (d) Volume — 50 ml. distilled water.
   (e) Agitation — Rolling boil or as indicated.
   (f) Method — (See above).
5. Drying: Suspended under infrared lamp until completely dry.

For the assay of the pans, the equipment consisted of a Geiger Müller tube with a mica window characteristic of 1.4 mg./cm.^{2}, with a 64 scaler and a timing device.

Of the many corrections which should be made in much radioisotopic work, it was possible to eliminate most since the method was to be used as a "null" point. That is, the goal was 100% cleanliness and no attempt was made to calculate the percentage soil removal. Concerning the sensitivity of the method, it was pointed out in a previous paper[4] that the tracer technique is sensitive to approximately 2×10^{-7} grams per sq. cm. of remaining soil. Still another paper to be published indicates that this degree of sensitivity is approximately ten times greater than the water break method which was found to be more sensitive than the other usual methods.

Since the geometry of the counting system was controlled by the holder, Figure 2, and the method of adjusting the pan, this factor could be neglected in our work. Because the layer of soil was so evenly spread upon the pan, and was of such small proportions, correction for self-absorption could be neglected since all pans were treated in essentially the same manner. The background correction was the only one

Table I

Comparison of Various Alkalies
Soil Removal Values

Combination: Santomerse No. 1 ..... 5%
Alkali 95%
Tested at 5% Solution Concentration

Alkali	*No. of Test Pans**	*Average Counts per Min.* *1st Wash*	*2nd Wash*
Sodium metasilicate	5	21.9 ± 1.4	17.2 ± 1.2
Sodium orthosilicate	5 (3)	19.5 ± 1.3	16.6 ± 1.2
Trisodium phosphate	3	38.6 ± 2.3	25.6 ± 1.5
Tetrasodium pyrophosphate	5 (3)	39.6 ± 1.8	29.6 ± 1.5
Modified soda	5	155.2 ± 4.0	35.5 ± 2.1
Caustic soda	5 (4)	226.7 ± 5.0	76.7 ± 2.9
Caustic soda	5 (4)	41.4 ± 2.0	19.7 ± 1.4

**Values in parentheses are replicates used for average value.*
Background: Average 18 ± 1 counts/minute.

used for this work, since extent of cleanliness depends upon approximating this value. The background count is dependent upon freedom of the working surface from radioactive contamination, and if this is absent, upon the effect of cosmic radiation.

Beta emitters such as carbon[14] are among the safest to handle, provided that the compound does not dust or is non-volatile. Radiation is stopped by glassware, and distances over four to six inches away from this source are "safe." However, the n-undecane used was comparatively volatile and all our work was accomplished in a hood since this type of personal contamination is most serious.

Because of volatility, care was taken that all soiled pans had the same treatment to eliminate volatility as a source of error in the cleaning operation. A hydrocarbon about twenty carbon atoms in length would have more nearly approached the characteristics of the lube oil used, but was considerably harder to obtain successfully for the "tagging" synthesis.

Figures 3 and 4 show the counting apparatus, and the comparative size of the pans used.

Materials used:

Sodium Metasilicate	Commercial, anhydrous
Sodium Orthosilicate	Commercial, anhydrous
Trisodium Phosphate	Commercial, Hydrated
Tetrasodium Pyrophosphate	Commercial, anhydrous
Modified Soda	Commercial
Caustic Soda	Commercially Pure
Soda Ash	58% Commercial
Santomerse No. 1	40% Active dodecylbenzene sodium sulfonate
Sterox CD	100% Active polyethylene oxide condensate
Sterox SK	100% Active polyethylene oxide thio ether
Sodium Resinate	Commercial Powder
Sterox MXP	Alkaline built nonionic

The values shown in Tables I and II are average for the several pans tested. In general, five pans were used for each test, washed once, assayed, and if the count exceeded background, were washed a second time. The variations about the count are the average probable errors of the count.

The average background count is also subject to a probable error, as shown. Consequently, in comparing

Table II

Comparison of Surface Active Agents
Soil Removal Values

Cleaner Composition	*5.0% Solution* *1st Wash*	*2nd Wash*	*2.5% Solution* *1st Wash*	*2nd Wash*
Sterox CD — Metasilicate 2.5% — 97.5%	—	—	18.4 (4)	18.2 (5)
Sterox CD — Metasilicate 5% — 95%	19.3 (5)	16.4 (5)	19.9 (4)	16.5 (5)
Metasilicate — 100%	—	—	97.9 (3)	27.4 (4)
Sterox MXP	19.8 (3)	16.1 (5)	37.2 (4)	18.2 (5)
Sterox SK — Metasilicate 5% — 95%	22.3 (4)	17.5 (5)	38.7 (4)	18.7 (5)
Santomerse No. 1 — Metasilicate 5% — 95%	21.9 (5)	17.2 (5)	21.8 (5)	—
Sodium Resinate — Metasilicate 5% — 95%	20.2 (4)	—	21.9 (4)	—
Sodium Resinate — Metasilicate 2.5% — 97.5%	27.7 (4)	—	—	—

**Values in parentheses are replicates used for average value.*
Background: 18 ± 1 average counts/minute.

one set of data with another the first criterion would be whether or not both values fell within the background range. If so, then the two would be considered essentially identical at that concentration, and their comparative values at the next lower concentration would be examined. Should there appear to be an actual difference at this point, then the sample most nearly approaching the background count would be considered the more effective. For example, from Table I a comparison of sodium orthosilicate with trisodium phosphate in both the first and second washes shows TSP to have the higher count, hence that it is less effective. Soda ash in the second wash approaches background, and could be said to be equivalent by washing twice to the silicates similarly treated. However, the first wash data immediately shows soda ash at a disadvantage, and about equal to TSP or TSPP at this point.

Discussion

Comparing the data for the alkalies of Table I prepared under identical conditions, using a composition of

5% Santomerse No. 1
95% Alkali

the following conclusions can be reached. For ease of removal at the 5% solution concentration level the silicates proved most effective. Less effective under these conditions were trisodium phosphate, tetrasodium pyrophosphate and soda ash. Relatively poor were modified soda and caustic soda.

Table II presents the data obtained by the dilution technique, comparing the several surface active agents with the recognized one containing alkyl benzene sulfonate. Comparison of these data with the recommended composition shows that at the 2.5% solution concentration level, where differences become apparent, that the Sterox CD-metasilicate compositions are equivalent to the alkyl benzene sulfonate product. A second but less effective level of soil removal was attained by Sterox MXP and Sterox SK-metasilicate. Poorest were metasilicate alone, or its combination with sodium resinate. At the 5% solution concentration level, only the 2.5% sodium resinate composition would be excluded.

Summary

The radioisotopic tracer method for determination of soil removal combined with a dilution technique proved suitable for the evaluation of combinations of various surface active agents and alkalies.

A relatively non-foaming composition consisting of 2.5% Sterox CD and 97.5% sodium metasilicate performed at least as satisfactorily as the better known lathering composition of 5% alkyl benzene sulfonate, 95% metasilicate composition.

Of the various alkali types used (in combination with Santomerse No. 1) the meta- and orthosilicates proved most effective, a second but lower level of effectiveness was attained by soda ash, trisodium phosphate and tetrasodium pyrophosphate, while still lower in soil removal were modified soda and caustic soda.

The valuable assistance of *W. H. Yanko* who prepared the radioisotopic n-undecane is sincerely appreciated.

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SOME INTERESTING NOTES ON THE PLATING INDUSTRY

Chrome Plating Gages Reduce Wear

Among various comparatively new applications of electroplating in the automotive industry is the extensive use of chromium plate on its plug gages and other measuring tools that are subject to excessive wear, according to the *American Electroplaters' Society*. The chromium plating is reported to increase the service life of plug gages more than one hundred per cent.

Electrolytic Tinplate

The electrolytic tinplate capacity of the nation has been increased by some 5 million base boxes yearly (approx. 1.1 billion square feet) as a result of the recent installation of what is said to be the largest and fastest tinplating line in the industry by *Weirton Steel Co.* Statistics show that this line is electrolytically coating strip steel with tin at a speed of 2500 feet per minute. Electrolytic tinplate is rapidly supplanting hot-dip tinplate in the container field.

The electroplating facilities of the automotive industry are tremendous. For example, latest figures obtainable (1949) show the present available plating power (in ampere) sufficient current to light all the homes in a city the size of Baltimore, Md.

Abrasive Methods—Surface Treatments—Control
Electroplating—Cleaning—Pickling—Testing

Shop Problems

METAL FINISHING publishes, each month, a portion of the inquiries answered as a service to subscribers. If any reader disagrees with the answers or knows of better or more information on the problem discussed, the information will be gratefully received and the sender's name will be kept confidential, if desired.

Silvering Pastes

Question: We would like to have some information on the paste type material now on the market for re-plating silverware. This material is simply rubbed on the parts and produces a silver plate. Can you give us this information?

M. F. M.

Answer: Several formulas may be used for producing a thin silver deposit on brass base metals by rubbing the paste on the parts. All of these materials incorporate a silver chemical and some other material which acts as a gentle polishing medium, so that the rubbing produces the deposit and rubs it bright at the same time. Only thin films are produced, however. Some of the possible pastes are as follows:

#1	Silver chloride	1 oz.
	Potass. bitartrate	1 "
	Water—sufficient to make a paste.	
#2	Silver nitrate	2 oz.
	Calc. carbonate	4 "
	Amm. chloride	1 "
	Sod. thiosulfate	4 "
	Water—sufficient to make a paste.	
#3	Silver nitrate	½ oz.
	Sod. hydroxide	1 "
	Sod. cyanide	2 "
	Water—sufficient to make a paste.	

All of the above formulas contain poisonous compounds, and rubber gloves should be worn to prevent silver staining of the fingers.

Improving Corrosion Resistance of Plated Parts

Question: We are in the business of finishing miscellaneous parts in copper nickel-chrome for busses and vans, and have run into the problem of having to re-finish some of the parts after they have been in service for as short a time as 3 months along the Gulf Coast. Some of these parts are badly rusted when we get them back, and we would like some suggestions as to what can be done to improve our results. Our present cycle consists of copper plate-buff-nickel plate-buff-chrome.

C. M. E.

Answer: The problem probably lies in the amount of deposit on the *completed* parts, assuming that you are plating an adequate thickness of both copper and nickel in the first place. A total copper-nickel thickness of not less than .0015 should give much better service life than you indicate. It is suggested that perhaps you are buffing off too much of the original deposits, or that certain areas are being laid bare by the buffing operations after plating. The outstanding advantage of bright nickel deposits is that the amount of nickel plated originally on the parts is the amount remaining on the completed parts, no intermediate buffing usually being required. You should consider using a copper plate-buff-bright nickel-chrome cycle as being superior to your present procedure. In view of the critical shortage of nickel at the present time we would suggest that you try plating enough copper on the parts so that *after buffing* you will still have about .001" left, then follow this with about .0005" of bright nickel before chrome plating. A composite coating of this nature should improve the corrosion resistance of your product considerably.

Barrel Polishing Lengths of Tubing

Question: We are faced with the problem of polishing 8 ft. lengths of steel tubing which will be used in the manufacture of tubular furniture. Do you know any reason why such parts cannot be polished in a long barrel? I fear that the long lengths will get dis-organized in the barrel and the bottom ones bent from the weight of the load above. We would appreciate any suggestions you could make.

V. O.

Answer: If you have a barrel long enough there is no reason why this method cannot be used. The parts can be prevented from damaging one another by making two disc-shaped racks, into which the ends of the tubing can be slipped, and placing one disc at each end of the inside of the barrel so that the tubes are held in a horizontal position. A spacer rod will be needed to keep the discs from working in toward the center during barrelling. The tubes should have sufficient spacing between them so that the polishing medium can work its way through them as the barrel rotates.

Another method which is popular for this type of work is to polish the straight lengths of tubing in an automatic centerless-type tube polishing machine, a number of which are available commercially. This latter procedure would undoubtedly be much faster than barrelling.

Cathode Agitation in Chrome Plating

Question: Can you give us any information as to why cathode bar agitation is not used in chrome plating as it is in other baths? It strikes us as curious that we have never seen a moving work rod in a chrome bath, and we wondered if there is any good reason for this?

C. R.

Answer: While moving the cathode rod is seldom used in chrome plating

there is no reason why it cannot and should not be used more widely. We have seen certain parts that could not be racked properly to prevent gassing from interfering with efficient plating of certain areas, and such parts would benefit from work rod movement. Somewhat the same effect is obtained by agitating the solution by pumping air through the bath, which is widely used commercially. Another practical consideration is in the rigidity of the electrical connections required, both between the rack and the work rod and the rack and the parts. Firm connections must be made, especially at the work rod, to prevent sparking and poor contacts. This is not so critical in other plating baths where much lower currents are involved. To insure such firm contact on a moving work rod would usually involve using much heavier racks, racks with more than one hanger (hook), or set screws on the rack, all of which are not as practical as they might be.

Interrupted Salt Spray Testing

Question: Can you tell us if it is advisable to stop our salt spray test at the end of each working day, continuing it in the morning of the next day? We cannot depend on our air pressure during the night and would prefer this method of test if it is all right.

T. S. P.

Answer: Standard specifications for salt spray testing call for an un-interrupted test cycle, except for brief daily periods when the test is stopped for examination of the specimens. Results obtained in this way would be expected to vary from an interrupted test such as you describe. However, if you are simply comparing the relative resistance to salt spray of two or more specimens your method might be all right. Such test result should not be compared to those obtained under standardized testing conditions by other laboratories. It would also make considerable difference whether or not you rinsed off the specimens each day or let the salt moisture remain on them overnight. Commercial equipment for salt spray testing is available which has its own air compressor, so that the test is independent of the plant air supply.

Silver Plated Electrical Contacts

Question: What is the usual thickness of silver plating applied to terminals and switches for electrical conductivity?

N. S.

Answer: The thickness depends on the application. For soldering terminals a good thickness would be in the order of .0003". For wiping-type contacts the thickness is much heavier, usually about .005". Other types of contacts might require deposits from .002"-.010" and higher. These figures are only approximate, and would vary considerably according to the experience of the user. For purposes of comparison, a triple-plate silver deposit on holloware is about .001" thick.

Copper Plating for Furnace Brazing

Question: We have been trying to use barrel copper plated parts, press fitted together, for furnace brazing, thus eliminating the placing of copper rings or pastes on the parts. Our success has been moderate; sometimes we get good results, then for no apparent reason we either get no joining of the parts or else the copper seems to "ball up," and causes bumps on the smooth surfaces of the pieces. Can you give us some ideas that may be helpful to us in overcoming this problem?

W. W. F.

Answer: Successful furnace brazing of copper plated parts depends on accurately and uniformly plated parts. If the copper is too thin there will be no joint formed, and if too thick the balling up occurs. A thickness of about .0003" seems to be about right. The problem is further complicated because of the barrel plating, where it is not so easy to maintain uniform plating thickness from part to part. That is why some parts from the same plating barrel load may fail while others work out successfully. Care and attention to all details of the plating procedure, so that uniform deposits are obtained, will enable you to use this process successfully. Another important point is to be sure that there is no grease or oil on the parts as they enter the brazing furnace. A degreasing treatment in trichlorethylene would overcome this problem.

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PATENTS

Improving Selenium Rectifier Action

U. S. Patent 2,504,226. *D. W. Rau and A. H. Bruemmer, assignors to Vickers, Inc.*

The method of enhansing the ability of selenium to resist current flow in one direction without appreciably increasing its resistance to current flow in the other direction which comprises converting selenium to the grey crystalline form, passing air between spaced electrodes connected to a high voltage source to generate nascent ozone, and directing said ozone onto said selenium for a period of from one half minute to five minutes.

Pyrophosphate Silver Plating Bath

U. S. Patent 2,504,272. *E. W. McCoy.*

A process for the electrodeposition of silver consisting of introducing the material to be plated into an aqueous solution consisting of between 2% and 5% by weight of silver pyrophosphate, an excess of pyrophosphate ion, in excess of two ammonium ions to each silver ion, and from 4% to 12% by weight of ammonium sulfate, the solution having a pH between 8.5 and 9.5, and passing an electrical current through the solution and to the material as the cathode.

Anodizing of Aluminum

U. S. Patent 2,504,434. *R. B. Mason, assignor to Aluminum Co. of America.*

In a process for forming an oxide coating on aluminum by treating in an aqueous carbonate type solution containing about 0.5 to 6 per cent by weight of alkali metal carbonate, the improvement comprising preliminarily providing in the solution a soluble salt of aluminum in an amount sufficient to increase the aluminum content of the solution by at least about 0.05 per cent by weight and a neutralizing compound reactive with the aluminum salt whereby to produce a condition of alkalinity in the solution in which there is an appreciable amount of aluminum complex of low solubility in the solution adapted to be precipitated as hydrated alumina, the neutralizing compound being provided in an amount approximating the stoichiometric amount for the reaction with the amount of the salt of aluminum provided.

Electroplated Binder for Abrasive Grinding Wheels

U. S. Patent 2,505,196. *J. C. Mays, assignor to The Carborundum Co.*

The process of making thin abrasive articles such as cut-off wheels which comprises providing a conductive parting layer on a conducting surface, depositing abrasive grain on said parting layer, and electrodepositing a metal stratum on said conductive parting layer and around said abrasive particles.

Plating Rack Design

U. S. Patent 2,505,212. *M. S. Schneider.*

An electroplating rack comprising in combination a single, elongated, substantially flat body member and a detachable elongated workpiece-engaging element connected thereto, said element including a resilient U-shaped portion adapted to grip said member, the legs of said portion extending over substantially the full widthwise extent of said member, and the interior widthwise dimension of said portion when unstressed being less than the thickness of said member, said element extending outwardly from the leg of said portion and disposed substantially perpendicularly thereto, said element having a plurality of workpiece-engaging V-shaped deformations adjacent each end thereof, and a second workpiece-engaging member having a U-shaped yoke clamped on to said body member and having oppositely disposed pairs of fingers, each pair extending substantially perpendicularly to the legs of the portion, and each said finger having a V-shaped deformation adapted to cooperate with the V-shaped deformations of said first mentioned element for supporting the workpieces in a selected position.

Automatic Polishing Machine

U. S. Patent 2,505,223. *F. R. Whitcomb.*

In a glazing and polishing machine, a work head, means to reciprocate said head, a pair of coacting work-engaging rolls, means to press said rolls against the work, and means to vary the pressure of the rolls against the work in pre-determined relation to the work travel during the finishing operation thereon and while the rolls remain in engagment with the work.

Plating of Fine Wires

U. S. Patent 2,505,531. *W. B. Ellwood, assignor to Bell Telephone Laboratories, Inc.*

A jig for positioning magnetic material wires in an electroplating bath consisting of a solenoid encompassing a plurality of magnetic cores coordinately arranged, each having an end face in the same plane and each being electrically insulated from the others, a guide for guiding each separate wire to be electroplated consisting of a slab of insulating material mounted in a plane parallel to the said plane of said core end faces and having a hole only slightly larger than and conforming in shape to the wire to be guided thereby for each of said magnetic cores constructed along the axis of each said core, a separate resistance element connected to the other end of each said core, said resistance elements having their other terminals multiplied to a common wire whereby a plurality of wires to be electroplated may be magnetically suspended through energization of said solenoid while each is connected in an individual electrical circuit by electrical connection to the face of the said core to which it is attracted and restrained from lateral movement away from its own axis and the axis of said core from which it is suspended.

Buffing Wheel

U. S. Patent 2,508,065. *F. E. Hendrickson, assignor to Murray Ireland.*

A hub assembly for supporting a plurality of buffer sections in circumferentially spaced arrangement comprising in combination, a onepiece disc having a plurality of circumferentially spaced holes extending therethrough in an axial direction, and a plurality of T-shaped hooks each having the two ends of its shank parallel to each other and offset from each other in a direction substantially perpendicular to the cross arm of the T, and adapted to extend through one of said holes with the offset in the hole, the two ends of the shank lying radial against opposite faces of the disc and the cross arm at the outer end for engaging and supporting a buffer section.

(*Continued on page* 96)

Adjusting Sulfuric Acid in Chrome Baths

The table below gives the amount of concentrated sulfuric acid to add to a chrome plating solution to bring the chromic-sulfuric ratio in balance. The figures for the acid are given in terms of *fluid ounces* of 66° Baume acid.

oz./.gal H_4SO_2 to be added	Fluid oz. of 66° Sulfuric Acid Required									
0.01	0.5	1.0	1.6	2.1	2.6	3.1	3.7	4.2	4.7	5.2
0.02	1.0	2.1	3.1	4.2	5.2	6.3	7.3	8.4	9.4	10.4
0.03	1.6	3.1	4.7	6.3	7.8	9.6	10.9	12.5	14.1	15.7
0.04	2.1	4.2	6.3	8.4	10.4	12.5	14.6	16.7	18.8	20.9
0.05	2.6	5.2	7.8	10.4	13.0	15.6	18.2	20.9	23.5	26.1
0.06	3.1	6.3	9.6	12.5	15.6	18.8	21.9	25.0	28.2	31.3
0.07	3.7	7.3	10.9	14.6	18.2	21.9	25.6	29.2	32.9	36.5
0.08	4.2	8.4	12.5	16.7	20.9	25.0	29.2	33.4	37.6	41.8
0.09	4.7	9.4	14.1	18.8	23.5	28.2	32.9	37.6	42.3	47.0
0.10	5.2	10.4	15.7	20.9	26.1	31.3	36.5	41.8	47.0	52.2
TANK SIZE IN GALLONS										
	100	**200**	**300**	**400**	**500**	**600**	**700**	**800**	**900**	**1000**

Note—The Data Sheet in the October Issue (1950) contains a chart that gives figures for chromic acid additions, in the event that the bath requires additions of both chromic acid and sulfuric acid.

To remove excess sulfuric acid from a chrome bath, add approx. 0.2 oz./gal. of Barium Carbonate for each 0.1 oz./gal. of excess sulfuric acid. Filter.

(From *Plating Tips*—L. H. Butcher Co., Los Angeles)

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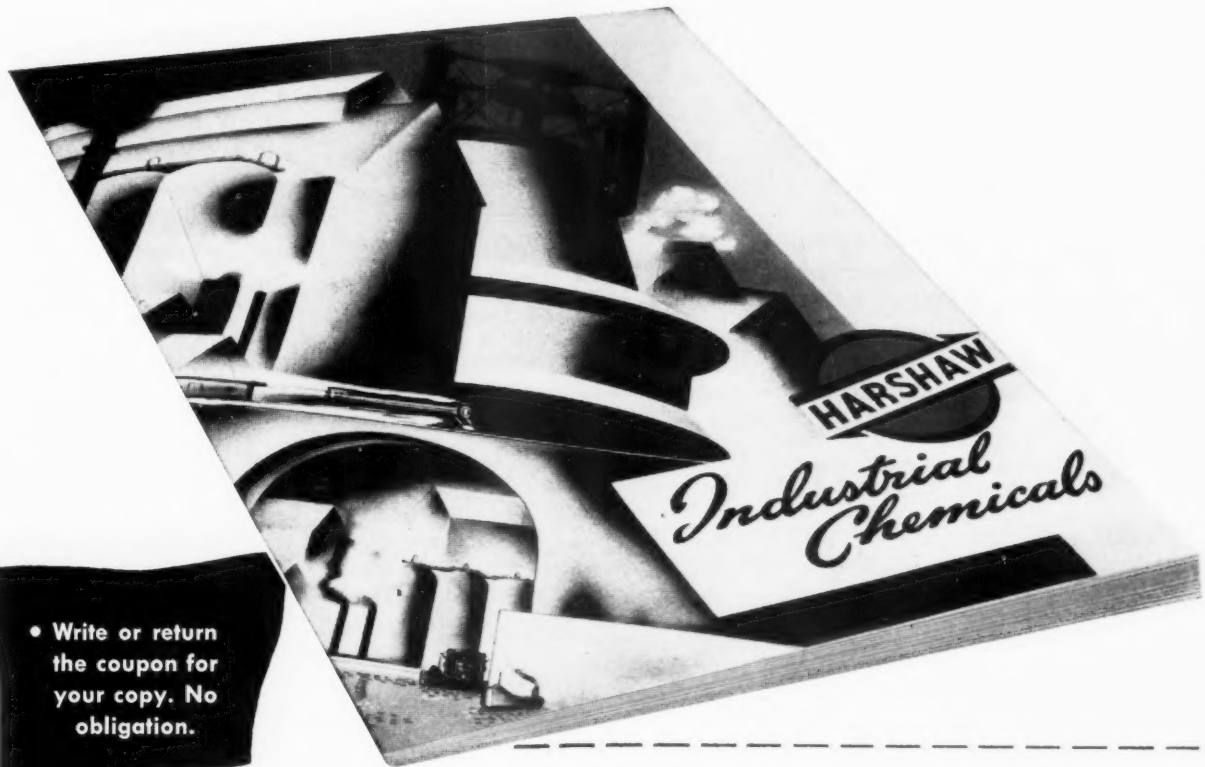

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HARSHAW

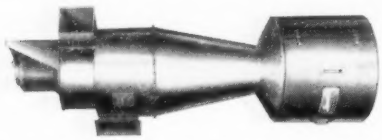
Recent Developments

New Methods, Materials and Equipment for the Metal Finishing Industries

Cyclone-Type Dust Collectors

Hammond Machinery Builders, Inc., Dept. MF, 1601 Douglas Ave., Kalamazoo, Mich.

This firm announces two new Models to their line of Cyclone-Type



Duskolectors. Model CYO-6, as shown, is recommended for installations for exhausting air to the outside. Model CYB-6, not shown, is of the same construction but is fitted with a dust proof bag, and is adaptable where conditions permit recirculating the air. Their larger dust capacity, and 2 HP motor provide a heavier duty dust collecting system for dust, grit, lint, saw dust, plastics, buffing compounds, etc.

Capacity of both models is 1150 CFM—velocity 5600 FPM with 2 HP motor. Base is 26" in diameter and dust pan capacity is 10,620 cu. inches. Overall height is 86", inlet size is 6" and outlet size is 7". For descriptive bulletin and complete details write to the above address.

Divco Adds New Efficiency Feature to Its 71-Point Anodes

Division Lead Co., Dept. MF, 828 West Kinzie St., Chicago 22, Ill.

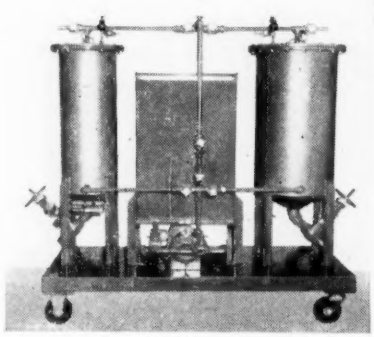
In their constant efforts to improve their product, Divco has adopted a corrosion-proof plastic coating called "Black Armor" to protect their anode hooks from chromic acid fumes, drag-out drippings, and spray. The coating adds materially to the service life of these high-conductivity copper hooks, making them last several times as long. Increased ease of handling is still another advantage which the "Black Armor" offers.

Divco 71-Point Lead Anodes with "Black Armor" protected hooks are sold at no increase in price. Further details may be obtained by writing to the above address.

Versatile Stainless Steel Filter With Variable Filtering Area

Titeflex, Inc., Dept. MF, 500 Frelinghuysen Ave., Newark 5, N. J.

Completion of a specially-designed filter unit has been announced by this firm. Constructed of 316 stainless steel, the new unit includes one filter chamber of 10 sq. ft. filtering area and one of 20 sq. ft. area. Also included is a precoat tank, and the unit is so constructed that filter chambers can be operated simultaneously with the precoat tank, or singly, as required. Thus a choice of 30, 20 or 10 sq. ft. filtration area may be obtained from the same unit. Peak operating efficiency is maintained at all times whether batch sizes are small or large, it is claimed. As all Titeflex filters, the unit described here uses permanent filtering elements within the chambers and requires no bags, pads or sheets. Due to the standard Titeflex backwash system, cleaning of the unit is accomplished in approximately 20 minutes, without manual labor. The manufacturer will furnish complete details, or a complete Titeflex filter catalog, upon request.



Sequestering Agent for Alkaline Cleaners

Enley Products, Inc., Dept. MF, 254 Pearl St., New York 7, N. Y.

This firm offers *Cleaner Saver*, a much-needed new sequestering addition compound for alkaline cleaners.

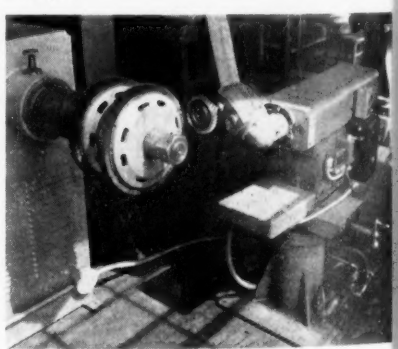
Cleaner Saver, when added to present cleaners in minute quantities (½ oz. per gallon), is claimed to increase the useful life and produce a more active and cleaner surface for plating. Precipitation of contaminants on the metallic surface is prevented, it is stated.

Cleaner Saver is said to possess the following desirable properties:

1. It dissolves metallic soaps.
2. Prevents contamination of metal surface by soaps or rosin acids.
3. Stabilizes metasilicate baths against colloidal precipitates after prolonged heating.
4. Prevents precipitation of calcium phosphates, silicates, and carbonates.
5. Deionizes heavy metal and alkali earth ions. Calcium, magnesium, iron, copper, manganese, nickel, zinc salts, etc., form inert complexes which stay in solution.
6. Withstands high alkalinity and high temperature indefinitely.
7. Retains sequestering power—is non-volatile.
8. Economical—½ oz. per gallon.
9. Remains stable and effective over a wide range of pH and temperature.

Brushing Method for Gear Deburring

The Osborn Manufacturing Co., Dept. MF, 5401 Hamilton Ave., Cleveland, O.

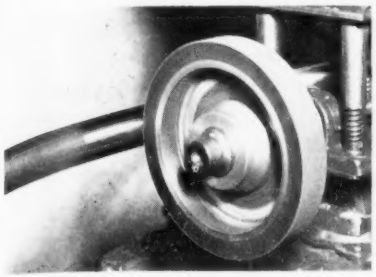


A new gear deburring method developed by the Technical Department of this firm uses the new Osborn semi-automatic universal work piece holder and brushing lathe. Using this new method for gear deburring, nearly ten times the work output is claimed. Using the old hand method, an operator

was able to produce only 20 finished gears per hour. With the new method, he was able to increase his output to over 180 finished gears per hour.

Improved Drum Sander

American Diamond Saw Sales, Dept. MF, 120 N. W. Ninth Ave., Portland, Oregon.



Two new improvements as well as a price reduction have been announced for the Cone-Loc drum sander.

The rubber cushioned sanders are now being ground at high speeds and a slight chamfer put in the lips where the drum splits in order to maintain perfect balance at high speeds.

The Cone-Loc drum sander is a hinged, split drum which permits use of coated abrasive strips without the troublesome and expensive joining of the ends of belts. Abrasive strips torn off the ordinary "utility" roll can be quickly wrapped around the drum, hooked over pins, and the two halves of the drum converted into a solid abrasive wheel by means of a cone shaped locking washer. Substantial savings in the cost of coated abrasives are claimed.

Many of the nation's largest industrial plants are now using the Cone-Loc drum sander for buffing and polishing operations on all types of materials from the hardest metals to plastics, wood, bone, etc., it is claimed. The sanding drum may be used on stationary arbor or flexible shaft.

Roof Ventilators

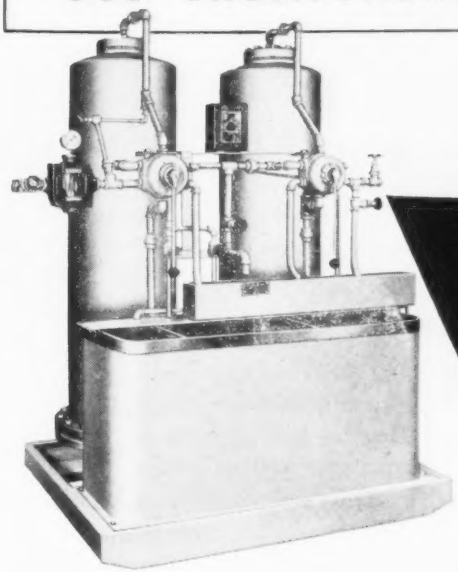
DeBothezat Fans Div., American Machine and Metals, Inc., Dept. MF, East Moline, Ill.

These motor driven vertical discharge roof ventilators are designed for exhausting air from foundries, machine shops and other buildings where harmful exhaust fumes must be disbursed into the air as high as possible above the roof.

Vertical discharge roof ventilators are available with fan wheels 36", 42"

Eliminate Hot-Rinse Stains
Unwanted Precipitates

USE CHEMICALLY PURE WATER



only a few cents
a thousand gallons
with . . . .

INDUSTRIAL Water Demineralizers

A Two-Bed INDUSTRIAL Water Demineralizer. Standard two- and four-bed units available with capacities of 200 to 1000 gph. Special units of any capacity engineered to requirements.

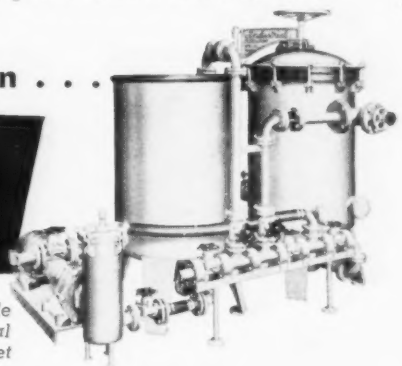
and it's as simple as it looks . . .

besides the extremely low cost, there is nothing complicated about getting the chemically pure water with Industrial Demineralizers. Raw water is passed through either two or four beds of ion-exchange resins and it comes out free of the dissolved mineral salts. No still, heat, steam, or cooling water is needed—keeping space requirements relatively small.

And it's simple to get the complete facts for your case. Send us a water analysis and let us know how much water you have to treat and the gallons per hour needed. We can then give you the whole demineralizer story including estimated costs, equipment required, performance data, etc. for your requirements.

for solution clarification . . .

use an INDUSTRIAL Filter



100 to 15,000 gallons per hour. Portable and stationary models. Standard or special filtration systems engineered to meet unusual requirements.

Write for full information and recommendations

FILTERS Pressure Type · PUMPS Centrifugal · CORROSION TESTING APPARATUS Salt Fog • Humidity

INDUSTRIAL FILTER & PUMP MFG. CO.

5906 Ogden Avenue
Chicago 50, Illinois

RUBBER DIVISION Vulcanized Linings • Molded Products · WATER DEMINERALIZERS

CASE HISTORIES

Actual Reports Available on Request

Cleaning Time Cut by 75%... Cleaning Material Cost by 70%... in Cleaning Before Plating at I-T-E Circuit Breaker Company

Parts Cleaned: Mild steel, copper and brass parts for electrical equipment. Dirts Removed: Stamping oils, chips and shop dirt.

Former Method: Stamped parts were cleaned in a manually operated vapor degreaser, plated or bonderized and assembled.

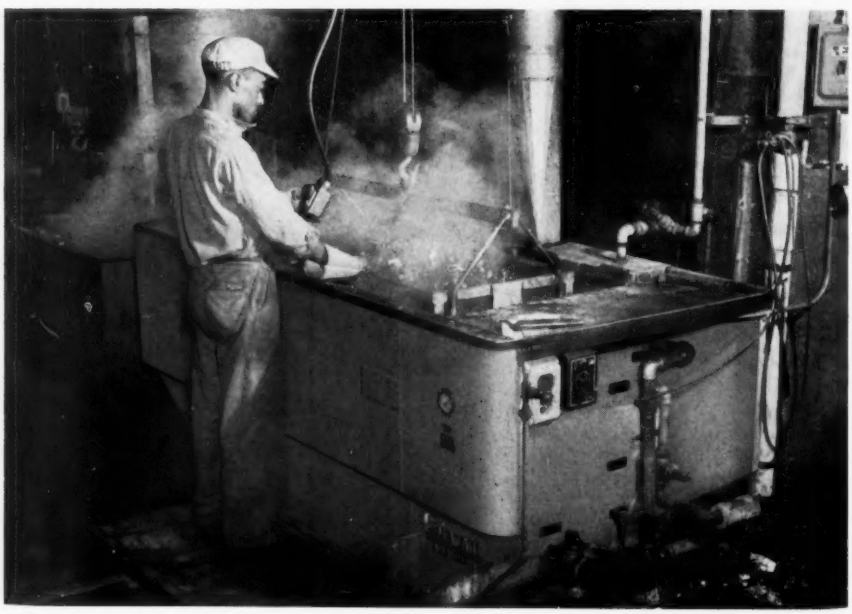
Present Method: Stamped parts are cleaned with Magnus 94XX (6 oz. per gal. of water at 200°F.) in a #4 Magnus Aja-Dip Cleaning Machine. Subsequent operations are the same as previously.

Result of Operation Change: At the time of changeover, a conveyorized vapor degreaser was under consideration to replace the manually operated degreaser. Preliminary tests indicated that the operation could be carried out much more economically with an Aja-Dip Machine and Magnus Cleaner 94XX, which were adopted.

Compared with the former use of the manually operated degreaser, the Magnus method cleans the same amount of parts in 10 minutes instead of 37 minutes. There is no increase in labor costs. The cost of degreasing solvent, which approximated $280.00 per month, was very high compared with the cost of only $70.00 per month for Magnus 94XX. In addition, the quality of cleaning obtained from the Magnus method is better than that from the previous method.

If you are looking for economies in cleaning costs prior to plating on steel, copper or brass, it will pay you to investigate the properties of Magnus 94XX (which is also in wide use for electro-cleaning of steel). With it, you can effect worthwhile savings in cleaning costs and definite improvements in cleaning quality. When used in a Magnus Aja-Dip, very large economies in labor and time are added.

For information, write Magnus Chemical Company, 11 South Ave., Garwood, N. J. In Canada — Magnus Chemicals, Ltd., Montreal. Service representatives in all principal U. S. cities.



and 48" in diameter and capacities up to 40,000 cubic feet of air per minute. The units are weatherproof at all times.

Colloidal Graphite Lubricant for Degreasers

Acheson Colloids Corp., Dept. MF, Port Huron, Mich.

The effective lubrication of conveyor chains which pass through vapor degreasers cannot be accomplished with ordinary petroleum products. If such are used, they are removed with all oils and greases in the passage of the chains through the degreaser tank.

The more petroleum lubricant applied to the chains, the harder the degreaser has to work to remove it. This contaminates the degreaser solvent faster.

One high-temperature lubricant that is successful in this application is colloidal graphite, a microscopically fine substance which lubricates effectively from sub 0° to 3,000°F. plus. Because of its extreme chemical inertness it is unaffected by degreaser solvents, and hence ideal for the purpose outlined.

This manufacturer recommends that colloidal graphite dispersed in alcohol be used on degreaser chains. The alcohol acts as a medium to transport the graphite to the points requiring lubrication. It is usually applied immediately after the chain leaves the degreaser tank and while it is still warm. By the time the chain completes its cycle and returns to the tank the alcohol has evaporated and the dry lubricating film is in position to carry the load.

Liquid Tripoli Compositions

Hanson-Van Winkle-Munning Co., Dept. MF, Matawan, N. J.

Acme 2-L-177 and 2-L-178 are the latest additions to the line of moderately priced liquid tripoli compositions made by the above firm. The new compositions are oil-water emulsions. Excellent cutting qualities are said to be combined with an unusually high coloring ability for the degree of cut obtained. Acme 2-L-177 is highly recommended for maximum cut and 2-L-178 for cut-color on such materials as brass, die castings and aluminum or wherever a general purpose tripoli would be used.

Anode Baskets Salvage Nickel Scrap

Automotive Rubber Co., Dept. MF, 5601 Epworth Blvd., Detroit 4, Mich.

Present shortages and even greater impending shortages in nickel for plating purposes indicate again the importance of utilizing scrap wherever possible.

Production can be prolonged and big savings realized if butts, sword ends and pieces of nickel that are

normally scrapped can be used in their entirety.

The above firm, specialists in the manufacture of insulated plating equipment, offer a line of insulated anode baskets for this purpose.

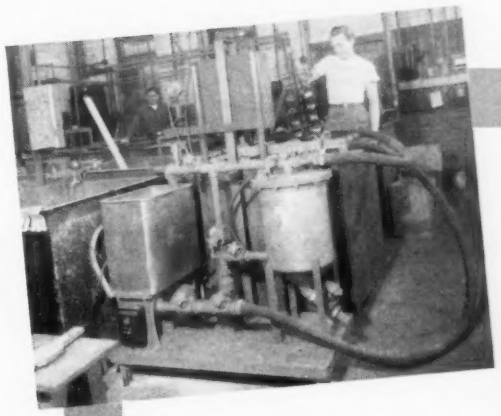
The baskets have welded steel cores and are completely coated with semi-hard rubber. They suspend from the anode rail and new anodes are suspended inside the baskets with the scrap packed tightly around them. The baskets are designed to absorb shock and cutting, it is claimed.

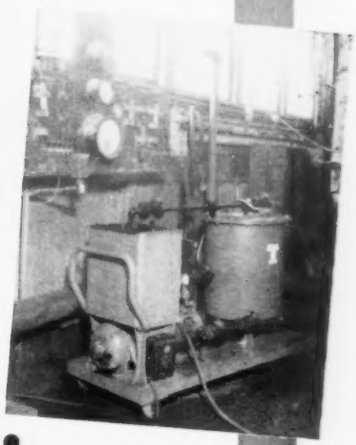
Bulletin No. 100 completely de-

Titeflex

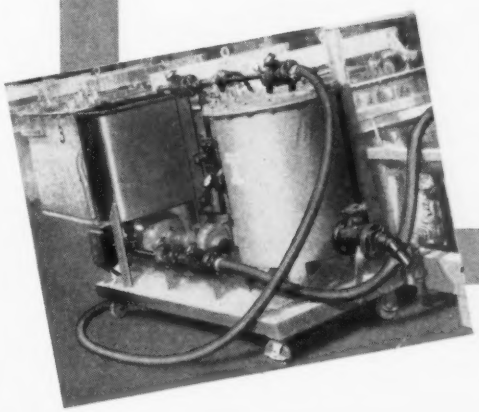
OPERATING SIMPLICITY

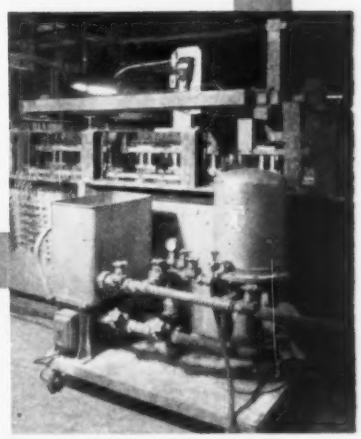
IS *Saving Money*





On All These Jobs...





Titeflex Filters operate entirely automatically. Precoating, filtration and cleaning all are accomplished merely by turning valves. In addition, Titeflex filters need no bags, pads or sheets. A few cents worth of filter-aid for each batch is the only requirement. Result: operation is speeded up, waste labor is eliminated, *filtration costs are lowered.* If you are seeking a highly efficient filter that will operate at lowest possible cost, find out about Titeflex.

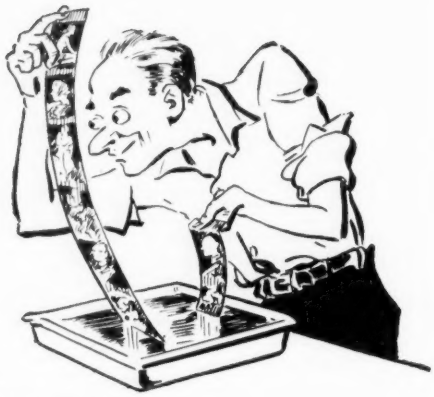
Write For Complete Catalog

Titeflex, Inc.

500 Frelinghuysen Avenue • Newark 5, New Jersey

TITEFLEX FILLS PLATING REQUIREMENTS TO A... T

Start Clean... Stay Clean!



A Must for Plater as Well as Photographer

The photographer would be foolish to risk his prize shots in developing solutions that are not quite pure.

It is just as bad to risk wasting time, labor and the expense of cleaning metal for plating by putting the work into a plating bath that may not stay pure. *Start* clean . . . *stay* clean with Red Label Darco S-51!

Red Label Darco adsorbs plating-bath impurities to *its* surfaces before they can be deposited on the freshly clean work. It is especially treated for use in plating — *every batch is laboratory tested to meet the benzol-mercury test!* Red Label Darco S-51 is easy to handle . . . easy to wet . . . easy to incorporate into a slurry. Practically all leading suppliers carry Darco in stock — place an order for Red Label Darco S-51 *today* — and don't accept substitutes!

Is your plating bath as clean as the water in your final rinse?

DARCO DEPARTMENT
ATLAS POWDER COMPANY
Darco General Sales Offices
60 East 42nd Street, New York 17, N. Y.

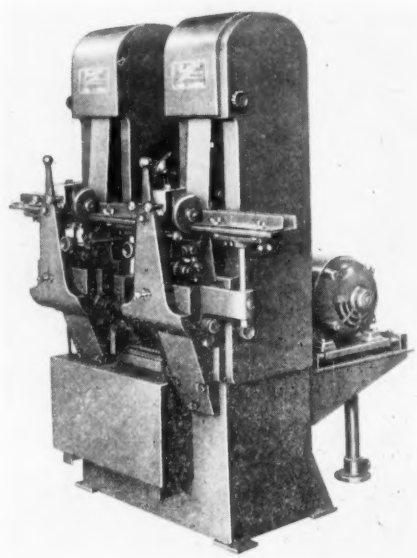
scribes this equipment and its use. The Bulletin and price lists will be forwarded on request.

Centerless-Type Tube and Rod Polishing Machine

Production Machine Co., Dept. MF, Greenfield, Mass.

As a result of a continued demand for a fast machine capable of producing a quality finish on small cylindrical work the Four-Eighty-Four Duplex Polishing Machine has been developed. Equipped with two polishing heads, this machine employs the use of abrasive, felt, leather or fabric belts, depending on the finish desired.

Shown for the first time at the A.S.T.E. Cost Cutting Show held at Philadelphia in April, the machine was acclaimed as one filling a long felt need for equipment of this kind. Having a capacity up to 1-1/2 inch diameter the machine will perform a two pass polishing operation on metal, wood, fibre, plastic, fibreglass and many other materials within its weight limitations. Only a single handling of material is required and many parts may be fed to the machine automatically by means of hoppers or fixtures suitable for the individual application. Costs can be reduced upward of 50 per cent on comparative work usually done on a single head machine, according to the firm.



Descriptive literature giving full particulars and specifications is available on request.

Durable Karbate Valve Spindles for Handling Corrosive Acids

National Carbon Div., Union Carbide and Carbon Corp., Dept. MF, 30 East 42nd St., New York 17, N. Y.

One of the common but serious complaints against chemical process valves is the corrosion and binding of metal spindle threads. An outstanding feature of "Karbate" impervious graphite globe valves is the self-lubricating, corrosion resistant threads on the bonnet and spindle, according to this firm. Users without previous experience with impervious graphite valves are often skeptical of the ability of the spindle threads to stand up under continued use.

The attached photograph is an untouched picture of the spindle from a 1" size valve that has been in continuous service for over two years. This valve was used to fill carboys from a sulfuric acid storage tank and was therefore subjected to complete opening and closing a number of times each day. The spindle threads show a very slight rounding, but are stiill in excellent condition. The disc on the spindle has worn exactly as expected and continues to re-seat itself.

Nickel-Alloy Heat Exchanger for Bright Nickel Solutions

Haynes Stellite Div., Union Carbide & Carbon Corp., Dept. MF, 30 E. 42nd St., N. Y., N. Y.

To cut down on replacement costs,

a Detroit bumper plating firm installed a heat exchanger coil fabricated from 12-gage welded tubing of Hastelloy "B". This nickel-base alloy is claimed to be particularly well suited for this application because it has high tensile strength and excellent thermal shock characteristics, in addition to superior corrosion resistance. Because of this good combination of properties, the coil could be fabricated with walls that are thin enough to assure good heat transfer, and, at the same time, strong enough to stand up under the impact of water hammer and the shock of sudden temperature changes.

After a full year's service, the Hastelloy coil shows no signs of wear, according to the firm. It has already lasted four times as long as the lead coil that it replaced, and should be good for many more months before failure.

Hastelloy "B" is one of a series of four nickel-base alloys produced in a variety of cast and wrought forms by the above firm.

Anode for Chrome Plating

Knapp Mills, Inc., Dept. MF, 23-15 Borden Ave., L. I. City 1, N. Y.

A recent development of interest to the chromium plating industry is the new Electro-Cupralum anode, produced by this firm. This anode, which combines the conductivity of copper with the protection of lead, is a development of the homogeneous extrusion process perfected by this company.

It has been recognized that the use of the customary lead anodes imposes limitations on the chromium plater, due to the low conductivity and relatively weak physical characteristics of lead. Efforts to overcome these handicaps through heavy lead thicknesses, special alloys, or the use of corrugations have been helpful, but not to the desired degree.

It was found that the homogeneous extrusion process was adaptable to the production of copper-cored lead anodes, so that they are simple to manufacture by a reliable method.

Aside from the very obvious conductivity and strength advantages of this anode, chromium platers will appreciate the reduction in overall weight, which simplifies handling. Also, the full width, continuous copper hook gives a much greater contact area. Full details may be obtained by contacting the producer at the above address.

Acid Pickling Inhibitor

Enthone, Inc., Dept. MF, 442 Elm St., New Haven, Conn.

A new type inhibitor has been recently announced by this firm. The manufacturer states that this inhibitor possesses many advantages not shared by any other inhibitor on the market to date. In summary, these advantages are said to be high inhibiting action in many types of mineral acids including hydrochloric, sulphuric and phosphoric acids; lack of odor; complete miscibility with pickling solutions; and ease of handling and economy of use.

The inhibiting action in such acids as hydrochloric and sulphuric acids is claimed to be of the order of 99% even at temperatures up to 130°F. The inhibitor is recommended for the pickling of wire, and tests have indicated a saving in acid drag-out as high as 30%, according to the firm. This saving in drag-out also is important because less acid is dragged into the lime solution that is normally used to neu-

NO SHUT DOWN
to carbon treat solution with . . .
horizontal
SPARKLER *plate* **FILTERS**

SPARKLER horizontal plate FILTERS

Only a few minutes are required to lift out the horizontal plate assembly in a Sparkler Filter and drop in a clean set of filter plates and production is under way without appreciable interruption.

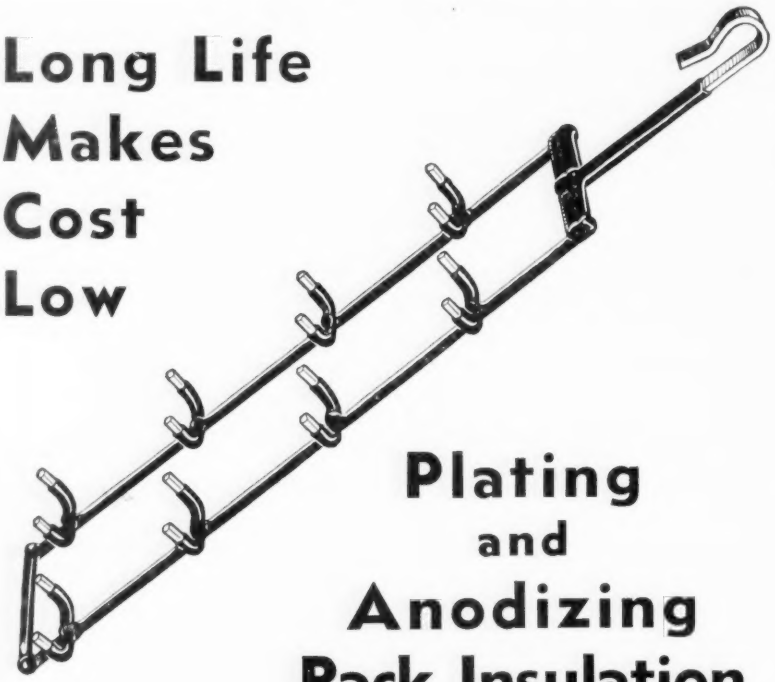
Tanks are given a carbon treatment without shutting down production in the battery installation shown here. One or two filters are cut out of the line, drained, cleaned and dressed with clean filter papers. The proper amount of carbon is mixed with water in a stand-by tank and recirculated through the filters thus depositing the carbon on the plates in a cake of uniform thickness and density. The solution requiring a carbon treatment is then circulated through the carbon beds giving the plating solution the carbon treatment without contaminating the tank or stopping plating operations.

Sparkler Horizontal Plate filters give absolutely sharp filtration at all stages of the cycle.

A battery of 18 Sparkler Filters in one of the largest bright nickel plating plants in the world.

SPARKLER
MANUFACTURING CO.
MUNDELEIN, ILLINOIS

Long Life Makes Cost Low



Plating and Anodizing Rack Insulation

BUNATOL No. 1002 Paste rack insulation will last for thousands of cycles through the Plating or Anodizing tanks. Such rugged insulation life coupled with very low first cost is what makes the use of No. 1002 an investment instead of an expense. No. 1002 is a 100% solids insulation without evaporation loss or waste. The high gloss and extremely tough insulation will withstand cuts and abrasion and rinses cleanly so as not to carry over solutions. Requires only a single Primer coat which will give extra strong adhesion to hold the insulation to the rack. So simple to use — complete insulation operation in two to three hours. That means quick service and low labor cost. Investigate the savings possible by insulating your own racks with BUNATOL. A note on your letterhead will bring complete information.

NELSON J. QUINN COMPANY TOLEDO 7, OHIO

— for 15 years —

Rack Insulation Exclusively

tralize the acid, which results in a lower amount of calcium sulphate forming on the work that usually contributes to rusting and lowering the lubricating qualities of the lime. Unlike many inhibitors, Inhibitor 8 is claimed not to increase hydrogen embrittlement of steel during pickling.

Inhibitor 8 can be removed by means of alkali cleaners or good running rinses. Any trace of inhibitor that may remain when rinsing is not done completely tends to lower the tendency of the steel towards rusting, which is particularly important in drying of steel on hot humid days.

The amount of inhibitor required is relatively low, being of the order of 0.1 to 0.2% by volume of the acid mixture, or from one to two gallons per thousand gallons of acid solution. In case an excess of inhibitor is added, there is said to be no danger of the formation of floating films to contaminate the work and, in addition, Inhibitor 8 has high tolerance to ferrous sulphate.

Enthone Inhibitor 8 is supplied as a clear, non-odorous liquid available in one-gallon cans and five-gallon and fifty-three gallon steel drums.

Light Weight Safety Goggle

American Optical Co., Dept. MF, Southbridge, Mass.

A new one piece, one ounce all plastic safety goggle designed to fit all faces is announced by the above firm.

Made of impact resisting plastic,

this one piece goggle is "optically correct," according to the firm. It affords wide angle vision and can be worn over most standard types of personal glasses and most prescription spectacles and goggles, it is claimed.

Other features are a comfortable plastic nosepiece, many perforations to minimize fogging and provide adequate ventilation, non-flammable plastic construction, and four point contact with face by means of rolled edges for greater comfort.

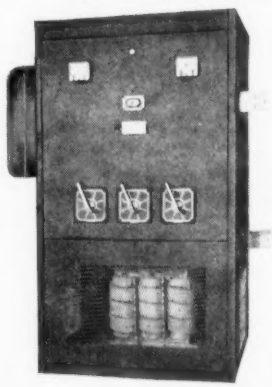
The new goggle is supplied in clear or green plastic styles, has an easily adjustable elastic headband to insure snug fit.

This new goggle is sold for protection against foreign particles striking from any direction on the following types of work: babbiting, chipping, cutting rivets, grinding, hand-tool operations, machine operations, spike driving and similar operations.

Rectifier

Rapid Electric Co., Dept. MF, 2881 Middletown Rd., Bronx 61, N. Y.

The above firm announces the release of a new rectifier, their Model #5M6 having a current capacity of



5,000 amperes from zero to six volts. This unit is claimed to be complete with basic rectifier section and voltage regulator all in one housing, is compact and offers ease and flexibility of use. The rectifier is well rated, incorporating the latest of techniques in stack assemblies and finishes, class "B" transformers which are guaranteed for 15 years and a fan assembly with heavy duty ball-bearing motor that requires maintainance but once each year according to the manufacturer. The unit was designed by one of the leading engineers in the industry. Only after months of laboratory testing and many weeks of actual field tests, was it added to Rapid's list of Stock Model Rectifiers.

Business Items

Conde New Sales Promotion Manager for Brady-Milwaukee

The *Brady-Milwaukee Div.* of *W. H. Brady Co.*, Chippewa Falls, Wis., manufacturers of Quik-Label Wire, Pipe & Conduit Markers and Die-Cut Masks, announce the appointment of *John P. Conde* as Advertising and Sales Promotion Manager. Mr. Conde will be located at the company's office at 204 W. Washington Street, Milwaukee 3, Wis.

Prior to his appointment at Brady-Milwaukee Co., Mr. Conde was advertising Manager of the Askania Regulator Co. A graduate of Purdue University, he was Managing Editor of "Modern Railroads" immediately following his graduation.

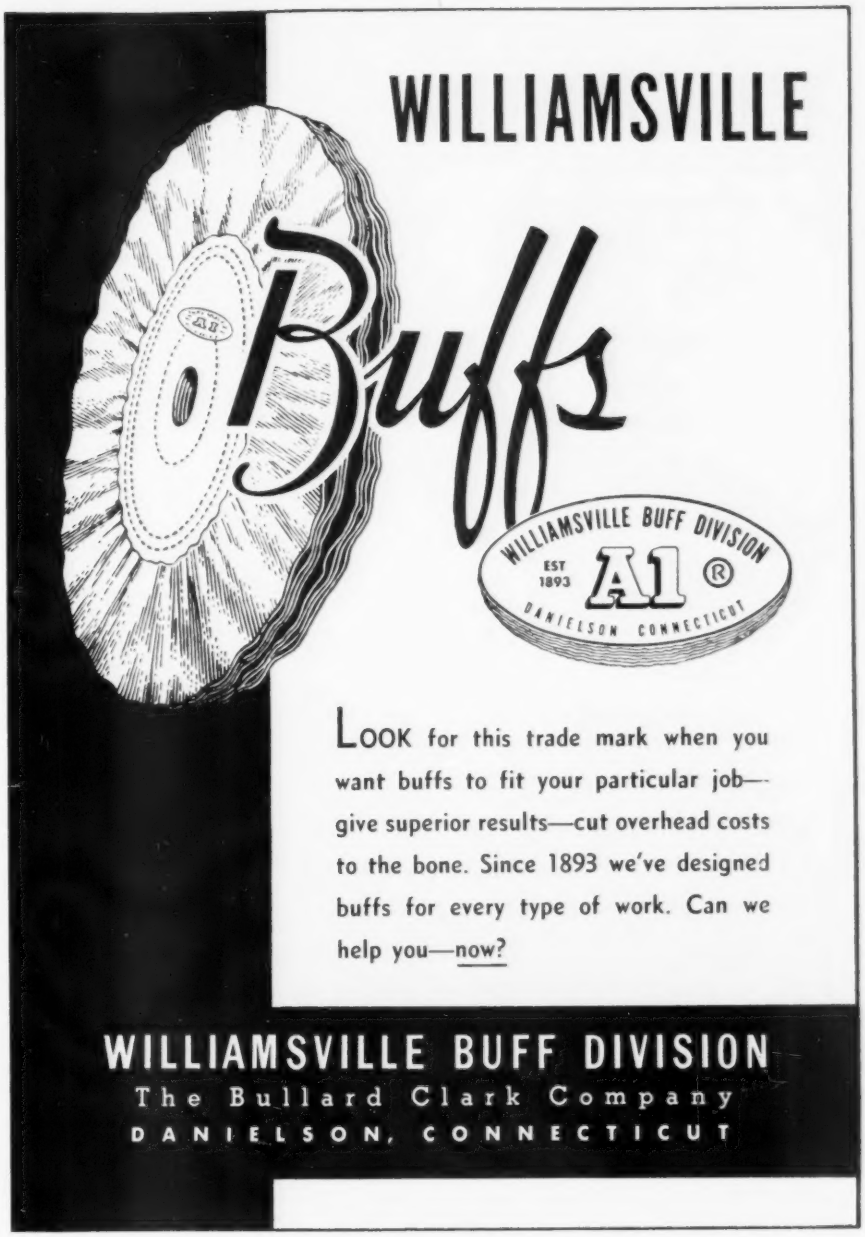
Roto-Finish Company Expands Plant

The *Roto-Finish Company*, of Kalamazoo, Michigan, is rapidly completing the construction of a new addition to its present plant.

The new unit will greatly increase the *Roto-Finish Processing Machine* manufacturing facilities, according to *D. T. Barrett*, President.

Rapid Electric in New Plant

The *Rapid Electric Co.* has recently announced the removal of their office and plant facilities from 2847 Middletown Road, Bronx, 61, N. Y. C. to the new factory located at 2831 Middletown Road, Bronx, 61, New York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The Bullard Clark Company
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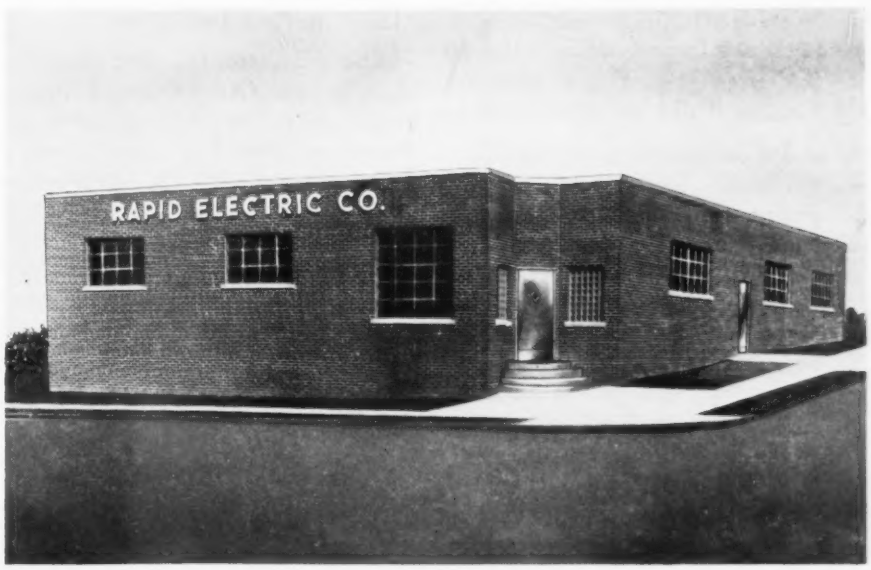
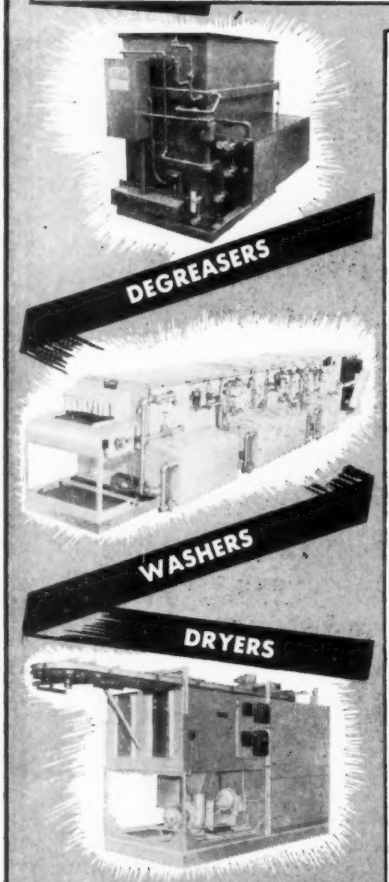


for METAL PARTS
DEGREASING, WASHING, DRYING



OPTIMUS VAPOR DEGREASERS, all types, vapor, vapor-immersion, vapor-spray, and combinations of these. All sizes from small batch-type degreasers to custom-built monorail or cross-rod conveyor models.

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OPTIMUS DRYERS—embody a specially designed system of adjustable directional jets, temperature, turbulence, and recirculation, to assure adequate drying after washing, before painting, and spotless drying after plating or polishing.

We offer you our experience in planning, designing, engineering and servicing metal cleaning equipment. Contact your local OPTIMUS office for information and advice on cleaning methods, or write us directly.

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The only degreasing solvents for all metals or combination of metals. More stable, both as a liquid and as a vapor, than any other chlorinated solvent. Warehouse stocks in all principal cities and industrial areas.

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City, which was especially constructed for the manufacturing of rectifiers and allied products for the plating industry.

3M Co. to Build in Cleveland

The Minnesota Mining & Manufacturing Co. has announced plans for the construction of a $250,000 branch warehouse and office building in Cleveland, Ohio. It will be located on Elmwood Ave. near West 117th St. The one-story, steel and masonry structure will contain 30,000 square feet of floor space.

The building will be served by New York Central rail trackage and will have complete truck loading facilities. It is scheduled for completion about Jan. 1.

Raybestos-Manhattan New Orleans Office at New Location

Effective October 1, *Raybestos-Manhattan, Inc.*, has announced the removal of its New Orleans office and warehouse from 1009 Camp Street to 920 Calliope Street. The new facilities will enable the company to serve customers in that area with a more complete stock of belting, V-belts, hose, other industrial rubber products, packings and asbestos textiles.

Quaker Chemical Products Corporation Enlarging Detroit Plant Facilities

Quaker Chemical Products Corp. has recently given out contracts increasing their plant and storage facilities in Detroit by approximately fifty per cent.

This increase is necessary because of increased business in that area despite the fact that the present plant and location was moved into just two years ago at 15330 Idaho Avenue.

Completion is scheduled for the end of this year.

Squitero New Electrochemist for H-VW-M

A. D. Squitero

The Hanson-Van Winkle - Munning Co., Matawan, N. J., announces the appointment of *Almo D. Squitero* to the post of Electrochemist in their laboratory. Mr. Squitero is a graduate of the Michigan State College with the degree of Bachelor of Science in Chemistry; he also had a year of graduate work in Electrochemistry. He has had wide experience in electroplating, electrotyping and electroforming.

Du Pont Expands Teflon Production Facilities

A new unit of the *Du Pont Company's* plastics plant near Parkersburg, W. Va., has gone into commercial production of "Teflon" tetrafluoroethylene resin, an industrial plastic highly resistant to chemicals and heat, and one of the best insulating materials known.

The new unit makes available to the chemical and electrical industries and other users of "Teflon" a productive capacity several times that of a plant at Arlington, N. J., where manufacture of the plastic in relatively small commercial quantities was started in 1943.

"Teflon" offers a combination of

chemical inertness, heat-resistance, and electrical insulating properties available in no other single material, it is claimed.

For the next few months the new Parkersburg unit will produce granular Teflon only. Further expansion, however, is under way for the manufacture of the new Teflon suspensoid, a suspension of minute particles of the plastic in a liquid, from which wire extrusion compounds and enamels, and corrosion-resistant finishes have been developed.

Gabriel New Ass't. Plant Manager for Atlas Mineral

Mr. George Gabriel, who has been plant engineer at the Mertztown Plant at *The Atlas Mineral Products Co.*, has been promoted to assistant plant manager.

Mr. Gabriel received his B.S. degree in Chemical Engineering from Pennsylvania State College.

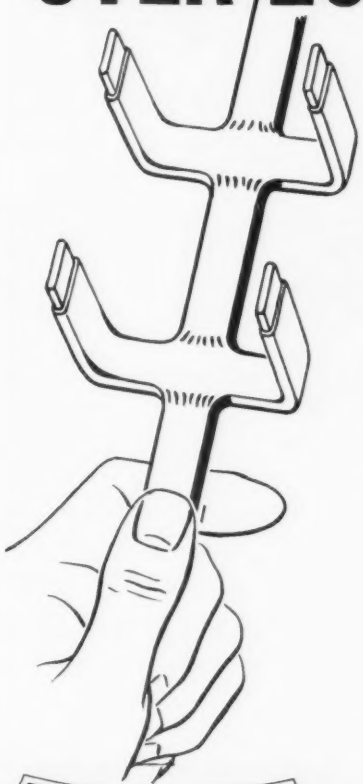
Jacobs New Head of Detrex Dallas Division

Announcement has been made by *W. F. Newbery*, Director of Sales, *Detrex Corp.*, manufacturers of industrial cleaning equipment and chemicals, that *Gordon A. Jacobs* has been appointed representative in charge of the Dallas Div., which includes the states of Texas, Louisiana, Oklahoma, and Arkansas.

Gordon A. Jacobs

Mr. Jacobs is a graduate engineer and has had broad experience in marketing, field servicing, and consulting on Detrex processes—including solvent vapor degreasing, alkali and emulsion cleaning, and rust-proofing.

COATING SURVIVES OVER 2500 CYCLES!



UNICHROME COATING 218X *again proves that it minimizes rack upkeep*

At a Michigan plating plant, Unichrome Coating 218X is considered to be "the best rack coating ever used." For good reason. Racks protected with this green plastisol coating have been working 16 cycles daily for 8 months — and the coatings are *still* in good condition!

Such service is not unusual for Coating 218X. It's one of the toughest materials — physically and chemically — that can be put on racks. It stands up in all plating baths, all cleaners — even vapor degreasers. Coating 218X is approved for leading bright nickels. Applicable in flexible coatings up to 3/16" thick, it won't tear or chip. And with but a *single* prime coat of Unichrome Primer 219PX used, you assure not only better adhesion, but savings in application time as well.

A United Chromium engineer is always ready to show you how to apply Coating 218X for top results. Or if you have no baking facilities, we'll gladly send you names of nearby qualified applicators who can apply it for you. Either way, you stand to gain substantial savings in rack maintenance. Send for data.

UNICHROME Trade Mark COATINGS for METALS

Metallic . . . . . Organic . . . . . Decorative . . . . . Protective

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Los Angeles 13, Calif. • In Canada: United Chromium Limited, Toronto, Ont.

Tin Research Institute, Inc., Reports on Its First Year Of Operation

In the Spring of 1949, the *Tin Research Institute, Inc.*, was established in Columbus, Ohio, to provide improved technical service to tin users throughout the United States. It is staffed by Americans who have been engaged for some years in dealing with problems related to tin. There are similar organizations in England, Belgium, and The Netherlands. A sponsorship with the Battelle Memorial Institute provides facilities for technical investigations and continues the relationship which has existed for many years.

The functions of this information center on the use of tin are threefold: the collection of information of value to tin users; the distribution of information; and the availability of a consulting service to assist industry in solving technical problems in the use of tin.

The collection of information is facilitated by abstracting about 150 of the important periodicals, reprinting research papers of the Institute staff and of other scientific and technical workers in all parts of the world. Surveys are made of the patent literature of the United States, Great Britain, France and Germany. Much information on the trends of industrial applications is obtained from visits to plants, from trade literature, and photographs illustrating different applications of tin. An essential part of

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for production black finishing of all steel parts . . . . . .

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Du-Lite was developed exclusively for the black oxidizing of steel. It has been perfected to do this *ONE* job superbly.

2 - A Lustrous Rust-Resistant Black . . .

Du-Lite produces a handsome, uniform, jet black finish — not a coating. Du-Lite becomes an integral part of the steel surface itself, and will not chip, peel, crack, or blister.

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The Du-Lite Process is trouble-free and results can be achieved consistantly without stoppages and slow downs.

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Du-Lite is inexpensive to install, and less costly to operate.

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Du-Lite's trained technical men will see that the process is properly installed and train your operators — your guarantee of steady production.

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the work of the Bureau is to maintain in London and Columbus a file of collected information for future reference.

The distribution of information is accomplished through distribution of the Institute publications to editors of newspapers and scientific journals and to over five thousand individuals in the United States who are on the mailing list. In addition, requests are received for publications from interested individuals as a result of press notices. In the last twelve months, the Columbus office received 2,317 requests for publications and 10,982 publications were distributed in answer to these requests.

Technical inquiries which require special attention or information not readily available in published form are steadily increasing as the work of the Institute becomes more widely known.

In the twelve-month period, five hundred and twenty inquiries relating to technical problems were directed to the Columbus office. Consulting work on these and other problems necessitated seventy-two visits to plants by the staff and fifty-five individuals came to Columbus to discuss their problems.

A wide variety of publications are available free of charge, to the practical user, to the analyst and to the research worker. Practical handbooks on hot tinning, electrodeposition of tin and tin alloys, soldering, bearings, fusible alloys of tin, and bronze are available on request. An illustrated review "Tin and Its Uses," which enables readers to keep in touch with developments in tin usage, is issued periodically. Anyone wishing to be on the mailing list for "Tin and Its Uses" or who desires any other information on tin should communicate with The *Tin Research Institute, Inc., 492 West Sixth Avenue, Columbus 1, Ohio.*

Mid-West Abrasive Co. to Produce Their Own Special Abrasives in New Plant

Quantity production of a new, efficient abrasive grain for use in making grinding wheels and sandpapers has begun in Owosso, Mich., with completion of *Mid-West Abrasive Co.'s* new abrasive grain plant. *James T. Jackson,* president and general manager, said the new grain, developed in Mid-West laboratories and tested in various plants throughout the country, has been proven superior to other abrasive grains for metal-working operations.

The new plant will permit large scale production of the new abrasive grain, which heretofore has been produced on a small or experimental scale by the Mid-West laboratory. The completed plant will include modern equipment for crushing abrasive material from lumps or "nuggets" into grain of various sizes, ranging from extremely coarse to grain of powder-like fineness. Measuring 342 feet long by 72 feet wide, and containing more than 100,000 square feet of floor space. The new plant was acquired by Mid-West last year. When in full operation, it will supplement the company's main factory on S. Washington St., in which a major portion of the company's grinding wheels and sandpapers are manufactured. A third Mid-West plant, used exclusively to produce grinding wheels, is located at Rochester, Pa.

Recently Mid-West Abrasive Co. announced gross sales during May, 1950, totaled $385,793.00, largest monthly sales in the company's 21-year history. The company's May, 1950, sales, Jackson said, exceeded the May, 1949, figure by 16 per cent.

Weaver Equipment and Supply Co. Opens Houston Office

The Weaver Equipment and Supply Co., newest firm in the electroplating and finishing supply field in the Southwest, has opened offices, laboratory and warehouse facilities at 1816 Pierce Ave., Houston, Texas. *Mr. James*

Weaver, well-known plating expert formerly connected with the Eastman Kodak Co., Rochester, N. Y., is the head of this firm. Among other accounts, he will sell and service the materials and equipment of the following firms;

Formax Mfg. Co., Detroit, Mich.
Manderscheid Co., Chicago, Ill.
Maas & Waldstein, Newark, N. Y.
U. S. Stoneware, Talmadge, O.

British Specialist Team Studies U. S. Plating and Finishing Techniques

A special productivity team of British experts in the field of metal and organic finishing recently spent six weeks in this country as guests of the *Economic Cooperation Administration's Anglo-American Council on Productivity* studying the latest techniques used in plating, electroforming, spray painting, surface preparation methods, and other allied fields. The British team was made up of members from the leading types of industry in that country, including the following:

J. N. T. Adcock, Ass't. Dev. Mgr., I.C.I. Ltd., Paints Div.

N. A. Tope, Tech. Dir., Montgomery Plating Co.

A. J. D. Lines, Ass't. Works Mgr., Lines Bros., Ltd.

Fred Willetts, Chief Met., W. & T. Avery Ltd.

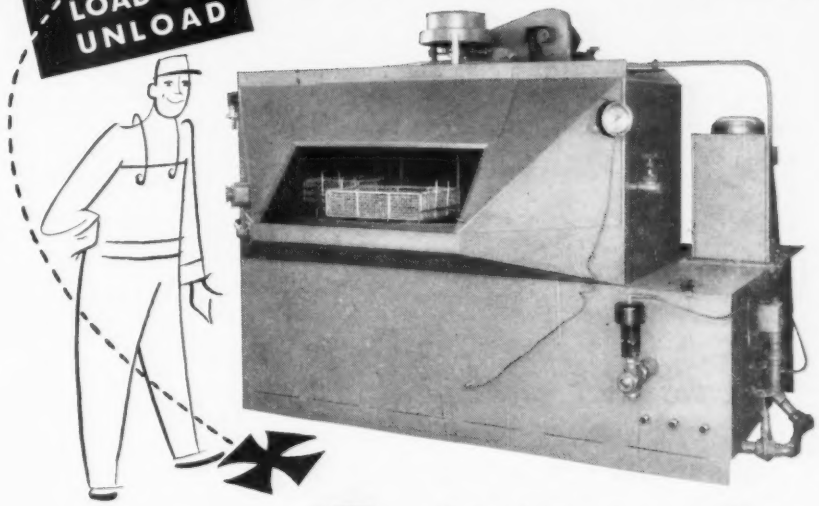
E. C. J. Marsh, Chief Chem. & Met., Standard Telephones & Cables Ltd.

B. Turner, Works Chemist, Monochrome Ltd.

M. F. E. Fry, Process Eng., Joseph Lucas Ltd.

ONE MAN OPERATION with BLAKESLEE METAL PARTS WASHERS

ONE SPOT LOAD and UNLOAD



BLAKESLEE SOLVENT VAPOR DEGREASERS
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BLACOSOLV
Stabilized Degreasing Solvent — one price, one solvent *for all metals*

Blakeslee's new washer saves labor, is economical

Just one man can keep the production line going with this time saving metal parts washer. Turn table operation permits loading and unloading in one easy pivot movement. One revolution of the washer turn table and parts come out sparkling clean for a better finishing job with fewer rejects. Blakeslee washers are designed for every type and size of plant operation. Write for the cooperative services of our engineer-trained sales representatives.

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New York, N. Y. Toronto, Ont.

L. J. C. Connell, Physicist, General Electric Co. Ltd.

G. H. Woodall, Res. Chem., W. Canning & Co. Ltd.

N. R. Watts, Res. Chem., Glasso Paint Products Ltd.

Dr. F. A. Champion, Head Corrosion Research, British Aluminum Co., Ltd.

V. Long, Branch Sec'y., Nat. Union of General & Municipal Workers.

R. A. F. Hammond, Head Electroplating Research, Ministry of Supply, Woolwich Arsenal.

Mr. Adcock, leader of the group, was representing the National Federation of Paint Manufacturers, and *Mr. Tope*, deputy leader, represented the Electrodepositors Technical Society.

The team visited many plants throughout the East and Middle West

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The mark that means
LOW-COST PRODUCTION OF TOP-QUALITY
Silver plating

This mark on every Handy & Harman Silver Anode means that every one is entirely free of all impurities which can cause plating troubles and measures up to the highest standards in fineness and physical properties. To silver platers, whether in the Arts or in Industry, these qualities mean profitable plating because they avoid interruptions to production and produce uniformly highest quality plating. Just try Handy & Harman 999 "PLUS" FINE Anodes and see the difference.

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with the object of finding production methods that might be adopted in England to raise the industrial production efficiency in the finishing trades.

Carl Dittmar, with DuPont 48 Years, Retires

Carl Dittmar, manager of the Cleveland district sales office of the Du Pont Company's Electrochemicals Department, retired today after a career of 48 years in the chemical industry.

Mr. Dittmar started with the *Roessler and Hasslacher Chemical Co.* in 1902, and has been the Cleveland manager since 1921, continuing in that position after Du Pont acquired that company in 1930.

He will be succeeded by *Albert R. Tucker*, who has served as manager of the Cleveland office during the last three months while Mr. Dittmar was on a leave of absence. Mr. Tucker was formerly manager of the Du Pont district office in El Monte, California.

Mr. Dittmar is a member of the Union Club, Midway Club, and Country Club of Cleveland. He and Mrs. Dittmar live at 13805 Shaker Blvd., Cleveland.

Royal Metal Completes New Plant

The Royal Metal Manufacturing Co., Ltd., recently announced the completion of their new general offices and showrooms at Galt, Ontario, Canada.

Horrell Co. to Handle Sly Equipment in Calif.

The *W. W. Sly Manufacturing Co.*, of Cleveland, Ohio, has appointed the *Horrell Co.* of 8006 Melrose Avenue, Los Angeles 46, Calif., to act as sales engineers for the Sly line of industrial dust control and sandblast equipment. The Horrell Co. have been established in Southern California for a number of years as consulting engineers and distributors of engineered products and equipment.

Desch New Research Chemist at Atlas Mineral

The *Atlas Mineral Products Co., Mertztown, Pa.*, has announced that *Mr. Robert P. Desch* joined Atlas as a research chemist.

Robert Desch graduated from Muhlenberg, receiving his B.S. degree in 1948, and a Master's degree from Williams College in 1950. He was a graduate assistant at Williams while working on his advanced degree.

PATENTS

(*Continued from page* 81)

Electropolishing Non-Ferrous Alloys

U. S. Patent 2,506,582. *E. der Mateosean*

The method of electrolytically polishing a metal selected from the group consisting of brasses, bronzes, copper, cobalt, nickel and ferrous metals comprising, making a specimen of the metal the anode of an electrolytic cell in which the electrolyte consists essentially of a solution, substantially saturated at room temperature, in which the solute is an alkali metal salt of an acid selected from the group consisting of boric, thiosulfuric and orthophosphoric acids and the solvent is water, and a completely water miscible organic alcohol, which electrolyte is self-buffering at a pH suitable for polishing, maintaining the anode at a temperature below that of the electrolyte, and passing an electric current through said cell whereby a metallographic polish is effected on said specimen.

Tarnish-Resistant Wrapping Cloth for Silverware

U. S. Patent 2,506,731. *J. C. Moss, assignor to Celanese Corp. of America.*

A method of preventing tarnishing

of the surfaces of silverware, which comprises placing said silverware in a covering shaped to receive said silverware, said covering comprising a fabric of closely woven construction containing filamentary materials having a basis of a lower aliphatic acid ester of cellulose.

Copper Plating Bottoms of Cooking Utensils

U. S. Patent 2,506,794. *J. M. Kennedy, A. P. Knight and H. J. Lee, assignors to Revere Copper and Brass, Inc.*

In an apparatus for electrodepositing on the bottom and side wall portions of the outer surface of revolution of a metal cooking vessel, a metallic coating which on said side wall portions is of gradually decreasing thickness as it approaches its upper edge portion and merges at its upper edge portion into said surface, which apparatus comprises a tank adapted to contain electrolyte at a predetermined level, a depending rotatable chuck for supporting the vessel, a traveling supporting carrier for the chuck, guide and supporting means for said traveling carrier, said guide and supporting means including progressively elevated portions formed at spaced intervals, automatic means for intermittently moving said carrier to said progressively elevated portions to position said chuck at predetermined levels with respect to the electrolyte in said tank, power driving means for rotating said chuck mounted on said traveling carrier, and means for supplying power to said power driving means at said spaced progressively elevated portions.

MUTUAL RESEARCH

LEADS WAY TO LOWER COST

CHROMIC ACID TREATMENTS

Possible cost savings in chromic acid anodizing, as well as in other metal treatments such as copper stripping, brass pickling, magnesium dips and chromium plating, are indicated through the use of oxidation-resistant cationic exchange resins. In a preliminary investigation by Mutual Chemical Company of America, certain commercial resins have been found to be stable in the presence of chromic acid. As a result, these resins may be used for removing dissolved metals from chromic acid solutions with the recovered chromic acid made available for re-use. An added advantage is in minimizing the problem of waste disposal.

Write today for a copy of "Regeneration of Chromic Acid Solutions by Cation Exchange" Mutual's Serial No. 65.

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SINCE 1845

MUTUAL CHEMICAL CO. OF AMERICA
270 MADISON AVENUE • NEW YORK 16, N. Y.

Belt Polishing Machine

U. S. Patent 2,507,372. *A. N. Emmons, assignor to Porter-Cable Machine Co.*

An abrasive belt grinding and polishing device comprising a base member adapted to be mounted on a bench and having an upwardly extending portion, an arm member of channel formation with the sides thereof terminating in spaced apart disks overlapping said upstanding portion of the base, and means cooperable to secure the arm to said base member, the wall intermediate the sides of said arm being formed with an elongated slot, a plate mounted on the arm, fastening means extending through said slot and being cooperable to secure the plate to the arm, a bracket pivotally mounted upon said plate on an axis extending transversely of the arm, an abrasive belt pulley journalled on the bracket, and means yieldingly urging the bracket about said axis to move said pulley in a direction away from the base.

Iron-Cobalt Alloy Plating

U. S. Patent 2,507,400. *F. De Marinis, assignor to The S. K. Wellman Co.*

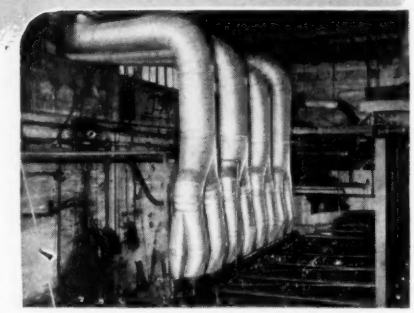
A method of protectively coating ferrous and bronze bodies which comprises the steps of providing a water solution of ferrous chloride in a concentration within the range of 250 to 400 grams per liter of water, cobalt chloride in a concentration such that the ratio by weight of the iron to the cobalt in the solution is from 80 to 99.75 parts of iron to 20 to 0.25 parts of cobalt, and calcium chloride in a concentration of 100 to 200 grams per liter; suspending in the said solution as cathode said bodies to be coated, passing an electric current through the solution with a density of from 10 to 490 amperes per square foot to form on the bodies continuous coatings composed of iron and coobalt; meanwhile maintaining the pH of the solution within the range of 1.2 to 2.4 and the temperature of the solution between about 70°C. and 95°C.; and replacing in the solution metals plated out therefrom to maintain the concentration of the solution.

Ohio FUME AND DUST REMOVAL SYSTEMS
TANGIBLE DOLLAR SAVERS

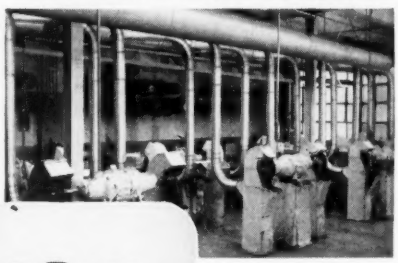
● Records on hundreds of Ohio Blow Pipe jobs prove without question that production output materially increased and employee absence and complaints radically decreased after the installation of an Ohio System for ventilation of fumes from plating and rinse tanks and dust collection from grinding, polishing and buffing.

Ohio Systems are not standard fit-all systems. They are designed and engineered to meet your individual requirements. Ohio engineers, thoroughly experienced in their field, make a careful, exacting survey of your plant and an analysis of conditions and then plan the system that will meet most efficiently your special needs and conditions.

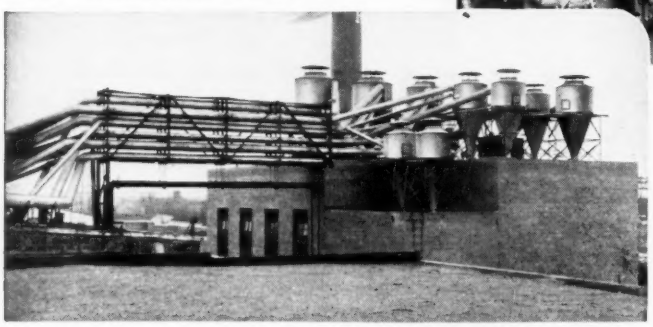
Call, write or phone today and let Ohio engineers make a survey and give you, without obligation, an estimate.



Fumes Removal Installation in Plating Room



Dust Collecting System for Buffing Machines



Cyclone Type Dust Collectors

Write today for free illustrated color folder showing you how an "Ohio" system protects your profits.

Ohio BLOW PIPE CO.
ENGINEERS AND MANUFACTURERS
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Automatic Polishing Machine

U. S. Patent 2,507,677. *C. I. Packer P. R. Nickerson and J. F. Harper, assignors to The Packer Machine Co.*

In a machine of the class described, a base; a jack mounted on said base, said jack having a lifting-head constructed and arranged to rotate about the substantially-vertical axis thereof and to move vertically thereon; a polishing-unit; means to support said polishing-unit on said lifting-head, said supporting-means comprising a boom adjustably secured at its lower end to said lifting-head and having a crank-arm at its opposite end for connecting said boom to said polishing-unit and arranged to provide multi-directional movement for said polishing-unit in a vertical plane; and self-locking adjusting means interconnecting said boom and said crank-arm and arranged to rotate said crank-arm and the said polishing-unit in the vertical plane of said boom.

Chromate-Phosphate Treatment for Steel

U. S. Patent 2,505,785. *H. R. Moore.*

A process of pretreating a ferrous metal surface, said process comprising immersing said surface in an aqueous solution including: sodium dichromate in the amount of about .78% by weight of solution, phosphoric acid about .59% by weight of solution, reaction product of 29 to 90 mols of ethylene oxide with 1 mol of lauryl alcohol about .002 to .2% by weight of solution; maintaining said solution at a temperature of about 195° to 205°F.; and withdrawing said surface from said solution after about 1 to 20 minutes.

Letters to the Editor

Likes New Guidebook

Metal Finishing Magazine
11 West 42nd St.
New York 18, N. Y.

Gentlemen:

We wish to acknowledge receipt of the Metal Finishing Guide Book Directory. This certainly is very complete in its information and we know it will come in handy a good many times.

We want to thank you very much for same.

Very truly yours,
OTTO CREUTZ
Creutz Platers, Inc.

Plating Gold Over Leaded Brass

Mr. W. A. Raymond, Editor
Metal Finishing
11 W. 42nd St., N. Y., N. Y.

Dear Sir;

With reference to the Shop Problem in your September issue, the following comments are offered as being helpful to the inquirer.

In leaded brass lead does not alloy with copper or zinc. It exists as practically pure lead in the grain boundaries.

The bonding of electroplated coatings is largely dependent upon whether the deposited metal will alloy with or diffuse in the basis metal. There can be what may be assumed as adhesion by an "anchorage" of the deposit to the basis metal.

* "The suggested solubility of gold in lead ranges from 0.09% near the eutectic temperature (215°C.) to 0.3% at 170°C.

* "The solubility of lead in solid silver is about 1.6% at eutectic temperature."

It is not probable that the adhesion of gold or silver electro deposits will be good. The gold or silver will cover the lead. The coating, however, will have a structure that will not afford good protection. If leaded brass is nickel plated the adhesion of the

nickel will not be good due to the sulfating of the lead in the nickel sulfate solution. A gold or silver deposit over the sulfated lead will be coarse grained and porous which even with the nickel will afford little protection against corrosion or wear.

Electroplated copper coatings on lead from cyanide copper solutions are quite adherent. A good practice is to apply a dense coating of copper on leaded brass as a basis for gold or silver electrodeposits. The adhesion of silver and gold to copper is well known provided a "strike" solution is used previous to the electroplate so as to prevent chemical precipitation of the gold or silver on the copper.

Specimens from production of large quantities of gold or silver plated leaded brass were recently examined after being plated more than 10 years. No diffusion or deterioration was evident. All parts were copper plated previous to gold or silver plating.

*A.S.M. Metals Handbook 1948 edition. Pages 1151 and 1152 respectively.

Sincerely yours,
GEORGE B. HOGABOOM

Distinguishing Between Various Bright Nickel Deposits

The Editor
Metal Finishing
11 West 42nd St.,
New York 18, N. Y.

Dear Sir,

I read with interest the question and answer regarding thickness testing of bright nickel plates (page 68 July issue). The following methods were devised in this country some years ago to distinguish between cobalt and sulphonate bright nickels:

Roughen the surface slightly by rubbing with a wet cloth sprinkled with pumice powder (no other abrasive must be used). Dry with a clean cloth and apply a drop of the following *cold* solution:—

Chromic acid	20 grammes
Conc. sulphuric acid	10 ccs.
Distilled water to produce	100 ccs.

If attack occurs rendering the drop brown within five minutes, then the deposit is of the sulphonate type, and a correction factor must be applied.

With the test solution used in this country in the ENF Jet Tests, (30% Ferric chloride plus 10% copper sulphate) the correction factor for the thickness of sulphonate nickels is 1.5. This method of identification would presumably apply also to such solutions as the Udylite which, while not actually using sulphonates, use closely related compounds.

Yours faithfully,
T. R. BURNETT, B.Sc.
Silvercrown Limited,
London, S. W. 8, England.

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Since they resist the corrosive action of all chemicals commonly encountered in plating operations, Hysol Coatings vastly reduce rack, tank and duct replacement costs. Offering far longer protection than conventional coatings, Hysol 3000 Coatings provide a smooth finished surface which holds solution drag-out losses to a minimum.

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News from California

Fire believed to have originated from defective wiring caused a damage in excess of $3,000 in the plating plant of *Buchanan's West Coast Plating Co.* 2125 Amey St., Los Angeles, on August 23. The plant had been active principally with auto parts plating, doing chrome, nickel, copper and cadmium work.

E. A. Vermere, of Vermere Plumbers Supply has moved his plumbing parts die casting plant from 1847 Randolph St., Los Angeles, to Malvern, Ark., where he now operates within about 25 miles of the Reynolds Company's aluminum reduction plant from which the bulk of his aluminum castings are derived. It is reported that the decision to move the plant to Arkansas was reached because the firm now chiefly serves eastern and midwestern accounts.

The plant facilities at 1847 Randolph Street, formerly occupied by the Vermere die cast plant and Auto-

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matic Polishers is now occupied by *Metallon Products, Inc.*, which specializes in stamping and plating plumbing fixtures. *Glenwood J. Beckwith*, formerly plant superintendent for Automatic Polishers, is now vice-president and general manager of Metallon Products.

Cee-Bee Chemical Co., Inc., Los Angeles, manufacturer of cleaning compounds, has announced the appointment of Lesco, San Francisco, as its representatives for the San Francisco Bay area and northern California territory.

Adams-Rite Mfg. Co., Glendale, Calif., is erecting a factory addition to handle its increased activity in the stamping, machining, plating and polishing of materials used in the production of locks for sliding doors and specialized builders hardware. The new building is expected to be ready in time for the celebration of the firm's 50th anniversary in business. The company is headed by *Arthur Adams*, as president, and *G. E. Lee* as operations chief.

American Can Company's eighth California factory is to be erected on a 35½ acre site acquired in the Wilmington area of the Los Angeles Harbor District. The building is planned as a one-story brick and steel structure of 200,000 square feet floor area. It will be equipped to manufacture food cans with a rated capacity of 350 million containers a year. The building is expected to be ready for operation by mid-year of 1951.

McClintock Mfg. Co., manufacturers and finishers of containers for the food industry, has announced a $300,000 expansion program, highlighted by the purchase of an industrial plant in the Central Manufacturing District of Vernon, Calif., at 2700 S. Eastern Ave. Additions being projected are expected to give the plant a total of 40,000 square feet of floor area.

Facilities for stamping, metal finishing and assembling metal promotional utility tables, cabinets and typewriter tables are included in the plans for a western branch plant of *Marshall Mfg. Co.* of Cleveland, O., which went into production in August at 311 West Avenue 33, Los Angeles.

Dates for the seventh Western Metal Congress and exposition have been announced as March 19 to 23, 1951, in the Oakland, Calif., municipal auditorium. The congress will be held under the management of the American Society for Metals and will be co-sponsored by 20 national societies in the metalworking and allied fields. *Harry L. Lewis*, chairman of the Golden Gate Chapter, ASM, is general chairman.

Sterling Electric Motors, Inc., Los Angeles, named *Allan J. Bronold* as sales manager, effective August 15. He took over the duties of Allen Adams, who resigned as sales manager due to illness after heading up the firm's international and domestic sales organizations for a number of years. Adams remains in the organization as secretary-treasurer.

John Merigold, retired former operator of the Merigold Plating Co., Los Angeles, returned to Los Angeles with Mrs. Merigold in mid-September from a visit of several months to New England. They went by plane to New York City, and thence to Worcester, Mass., for a visit with John's brother *Ralph Merigold*, who is connected with the Parker Mfg. Co. They subsequently spent a delightful stay at Elkin, N. H., and Lake Pleasant in the White Mountains. The bass fishing was good, said John.

Courses in Electroplating

Four classes dealing with subjects

of interest to members of the metal finishing industry are included in the 1950 schedules of the University Extension Division, University of California, for presentation in Los Angeles.

A class in the "*Science and Practice of Electroplating*" started September 12 at 1027 Wilshire Blvd., Los Angeles, with *Mitchell Raskin*, superintendent of the finishing department, Globe Lighting Products, as instructor. Classes are to be held each Tuesday night from 7 to 9:30 o'clock for 18 weeks. This course includes a comprehensive survey of the science, techniques and practices involved in the various methods employed in electro-plating for those engaged in some aspect of the field who wish to broaden their knowledge and experience. The course includes the chemistry of electroplating, plating and cleaning equipment, cleaning, pickling and stripping methods, racking, filtering, solutions and the various types of plating, including brass, bronze, cadmium, chromium, copper, nickel, silver, tin and zinc.

The subject material of another class is "An Introduction to Corrosion." *Gordon N. Scott*, Los Angeles consulting engineer is the instructor. Classes are being held at 813 South Hill Street, Los Angeles, on 18 consecutive Monday evenings, beginning September 11. Subjects presented include fundamental corrosion reaction and equilibrium, electrode potential, anodic and cathodic areas in free corrosion, measures of corrosion, aeration and acidity, reaction rates, inhibitors, assidity, protective coatings and engineering chemistry and physics.

Another course deals with protective coatings, paints, varnishes and lacquers for members of the organic finishing industries who wish to brush up on their knowledge of these subjects. *Lester Morris*, chief chemist of Amercoat Corporation, South Gate, Calif., is the instructor.

The university also is offering a chemistry course for members of the metal and organic finishing fields in which they may increase their knowledge of the technical phases of their profession. The course is entitled "*Introduction to General Chemistry*." It consists of 30 sessions. Beginning September 19, lecture classes were scheduled to be held each Tuesday night from 7 to 9 o'clock, with laboratory periods held on Thursday nights from 7 to 10 p.m., both in the chemistry building at the University of California at Los Angeles.

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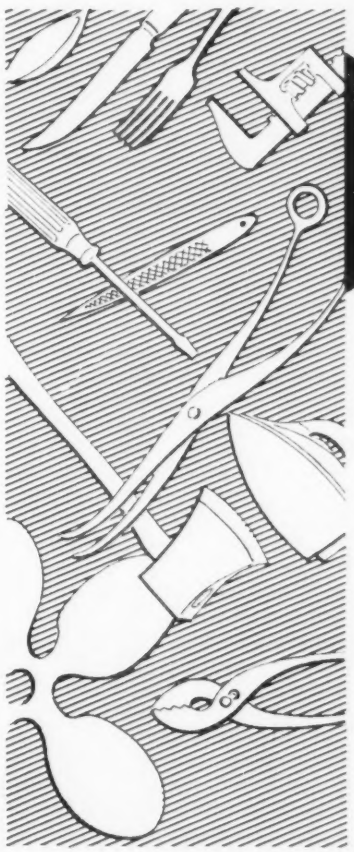

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NEW BOOKS

Industrial Chemicals

By W. L. Faith, D. B. Keyes, & R. L. Clark. Pub. by John Wiley & Sons, Inc. 650 pages. Price $8.00.

This book is a compilation of important information and statistics on the 106 most important industrial chemicals. Each chemical is treated in a separate chapter, and the information given for each chemical includes manufacturing processes in current use (with flowsheets), equations for the principle reactions involved, average yield in % of theoretical, raw material requirements per ton of finished chemical, labor and power costs, production figures for the past 20 years, general list of important uses, and information on properties, packaging, shipping regulations, commercial grading, etc. Also included is a map showing the location of manufacturing plants for each chemical, and information on trends, competitive products and processes, economical plant sizes and plant construction costs.

This is the first book of its kind, and one that will be much used as a reference by the busy user, buyer, and seller of chemicals. The authors are to

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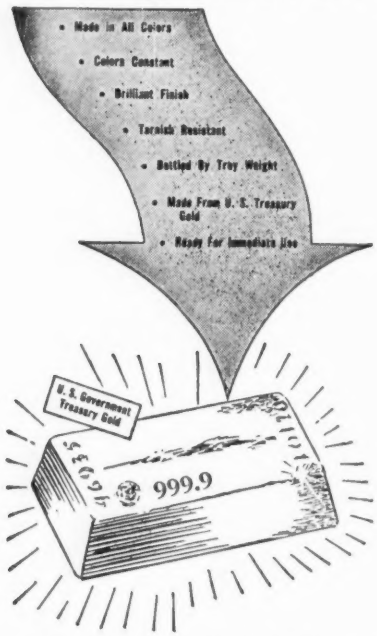
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be complimented on a painstaking and thorough job, and it is hoped that future supplementary editions will include an even wider range of chemicals which, while they may not be as important from a tonnage standpoint, are vital to the operation of many smaller industries.

W. A. R.

Transactions of The Electrochemical Society — Vol. 95 (1949)

Pub. by The Electrochemical Society, 235 W. 102 St., N. Y. 25, N. Y. 375 pages. Non-members price $6.50.

This volume contains the annual reports of officers of the Society, news of Award Winners for the year, and proceedings of the 95th General Meeting, in addition to the complete technical papers presented at the Philadelphia meeting in May, 1949. Most of the technical papers were on subjects which would not be of interest to electroplaters, but the following papers are also included:

A Unified Mechanism of Passivity and Inhibition, by *R. B. Mears.*

The Electrodeposition Behavior of Traces of Silver, by *Rogers, Krause, Griess,* and *Ehrlinger.*

Electrodeposition of Germanium, by *C. G. Fink* & *V. M. Dokras.*

Deposition of Metals on Aluminum by Immersion, by *S. Heiman.*

Electrodeposition of Rhenium from Aqueous Solutions, by *Netherton* & *Holt.*

Associations and Societies

AMERICAN ELECTROPLATERS' SOCIETY

Philadelphia Branch Annual Meeting and Banquet

The Philadelphia Branch of the AES will hold its Annual Educational Session and Banquet at the Broadwood Hotel, Broad and Wood Streets, Philadelphia, on Saturday, November 18, 1950. The following program has been arranged:

EDUCATIONAL SESSION — 1:30 P.M.

Speakers:

Dr. William Blum, Chief, Electrodeposition Section, National Bureau of Standards—"*Effects of War on the Electroplating Industry*".

R. O. Hull, R. O. Hull and Co., Rocky River, Ohio—"*New Ideas in Plating and Control*".

A. W. Logozzo, Nutmeg Chrome Corp., Hartford, Conn. — "*Hard Chrome Problems*".

The banquet will be held at 7:00 p.m. followed by entertainment and dancing. Tickets for the banquet will be $5.00 per person; no charge for admission to the Educational Session.

Los Angeles Branch

The Los Angeles Branch opened its fall semester of meetings Sept. 13 with a session at Rodger Young Auditorium which drew an attendance of more than 80 members and guests.

Attention was given at the meeting to the decrease in branch membership which, as of September 13, had dropped enrollment to 193, the first time the branch has been below 200 for quite some time. A committee went into the matter of whether the branch's educational programs were sufficiently interesting and intriguing to attract and hold the members.

A discussion of 1951 convention plans was also held. President *Dick Wooley* announced that the following local committee chairmen for the 1951 convention had been submitted to National headquarters:

Educational Committee—*Myron H. Orbaugh*, Bone Engineering Co., Glendale, Calif.

Finance Committee—*Howard H. Woodward*, Barber-Webb Co., South Gate.

Registration Committee—*Peter Rogers*, Oakite Products, Inc., Los Angeles.

Hotel Reservation Committee—*Harold Kroesche*, Harshaw Chemical Co.

Program Committee Chairman — *Stewart Krentel*, Shepard & Kent, Inc.

Entertainment Committee — *D. G. McDonald, Jr.*, Hall-Mack Co.

Publicity Committee—*George Kent*, Shepard & Kent, Inc.

Banquet Committee — *Ed Wells*, Chas. F. L'Hommedieu & Sons.

Outing Committee—*O. J. Jacobson*, Los Angeles.

Hotel Committee — *John Milhorn*, Mefford Chemical Co.

Ladies Committee—*Mrs. Earl Coffin*.

Exhibit Committee — *Kasmir Tarczynski*, S. & M. Lamp Co., Los Angeles.

Plant Visitation Committee — *Dean Williams*, L. B. Butcher Co.

Sight Seeing Committee—*Earl Coffin*, Palace Plating Co.

Transportation Committee — *Jack Beall*, A. J. Lynch Co.

The following guests were introduced: *Gregg Lagutari*, Standard Plating Works; *George Magurean*, U. S. Spring & Bumper Co.; *William Douglas*, R. C. H. Supply Co.; *Ted Goodman*, Santa Monica Plating Co.; *Richard Crane*, Waterbury, Conn.; and *Earl Loesch*, Windsor Fixture Co.

Mr. Crane, of Waterbury, Conn., who has attended most national conventions during the past 20 years, was called upon for a few remarks. He predicted that the attendance at the 1951 convention might well surprise everyone, unless unforeseen international developments occur.

Donald Bedwell, general chairman of the 1951 convention committee, announced he would not be a candidate for national office in 1951. President Wooley thereupon appointed a committee which was delegated to recommend a branch member upon whom the membership could concentrate its support for a national A.E.S. post next year. The committee is to report at the October general meeting. Morris Schwartz is chairman, with Don Bedwell, Ed Wells, Roger Sundmark and Leo Atimon as committee members.

The feature of the night's educational session was a panel discussion on copper plating. In the order of their appearance, *Stewart Krentel* of Shepard & Kent, Inc., Los Angeles, discussed cyanide copper solutions; *Mr. Wooley*, Pacific Coast district manager for United Chromium, Inc., discussed pyrophosphate solutions; and *Mr. Orbaugh*, of the Bone Engineering Co., outlined the advantages and disadvantages of acid type copper solutions.

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Southeastern Branch

The regular monthly meeting presided over by Pres. *E. J. Slemons*, was held at the Robert Fulton Hotel on Friday, Sept. 8th, with 16 mmebers present. It was decided after some discussion that we would hold future meetings in the dining room of the Georgia School of Technology.

The subject of a branch library was again brought to the floor and it was decided to make an effort to put one in the library at Ga. Tech., and also try to put one at Birmingham, Ala. and Jacksonville, Fla., *George Taylor* to take care of Jacksonville, and *D. J. Griffin*, Birmingham libraries.

The subject of membership was brought up by *Dave Griffin*, who asked help in obtaining new members. The following members were appointed to serve with him as a membership committee; *Geo. W. Taylor*, Jacksonville District; *Geo. Markle*, Chattanooga District, and *C. H. Hohner* (at large). Dave will take care of the Birmingham District.

The question of publicity in our local papers was again brought up and our good friend *Carl Cartledge* was appointed as publicity chairman and we

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feel sure he is going to do a good job.

Our speaker of the evening was Librarian *Dr. Fred Cox*. The subject was "Research and Our Guest Speakers for the Coming Year". Dr. Cox presented a very interesting talk as usual.

Detroit Branch Educational Session and Party

The Annual Educational Program and December Party of the Detroit Branch is being held this year on Saturday, December 2nd, at the Statler Hotel, Detroit.

The Educational Program, which begins at 2:00 P.M. will include three well-known speakers — two on technical subjects, and one a general interest address by a prominent executive in the automobile industry. The Chairman of the Educational Session will be *William Neill*, National President of the A.E.S.

The Banquet and Entertainment Program begins at 7:00 P.M. in the Main Ballroom of the Statler and, as usual, includes top notch talent and one of Detroit's best dance orchestras.

The technical speakers are:—

1. *Dr. George Jernstedt*, of the Westinghouse Electric Co. on the subject: "Applications of Wes-X Copper and P.R. Plating".

2. *Harland V. Ogle* and *Dr. E. T. Ewing*, of Michigan State Col. on the subject: "The Distribution of Metallic Impurities in Nickel Deposits".

The popular talk is expected to be by a top executive of the Ford Motor Company.

Tickets for the Banquet are on sale and may be obtained by writing to *Carl E. Heussner, 552 Brookside Dr., Birmingham, Mich.* The cost of the dinner and entertainment is $7.50 per person. The Educational Session is open to all interested parties.

Chicago Branch

Fifty-three members and guests attended the September meeting, the first education session to be held following the Summer vacation. The subject of the meeting was "Plating Room Waste Disposal".

Our speaker for the evening, *Dr. William Langdon*, of Graham, Crowley & Associates, ably pinch hit for *Dr. Clyde Crowley*, who was to have been the speaker but who was not able to be present due to a severe case of laryngitis. Dr. Langdon covered the subject in a most thorough manner, outlining advantages and disadvan-

tages of various systems in use today. Following the talk the speaker answered numerous questions on this most timely subject.

Those in attendance also appreciated a most enlightening discussion by *Mr. W. O. Zinn*, of the National Plating Co., on the subject of material shortages. Emphasis was placed on the necessity of conserving critical materials by improving methods, increasing efficiency, reviewing present conditions and making changes where necessary, and in general eliminating waste wherever possible.

Rochester Branch

The September meeting of the Rochester branch of the AES was held in the Rochester Institute of Technology on September 18th. Twenty members were present to hear from *Mr. Charles Kuhferschmidt*, safety engineer of the Rochester Products Division of General Motors, Inc. His topic was "Industrial Safety", and his talk was supplemented by a sound film on safety procedures in industry.

The talk was very well received and an enlightening discussion followed the speaker's presentation.

Cincinnati Branch

An enthusiastic group of the Cincinnati Chapter of the AES opened the 1950-51 season on September 27th with an excellent dinner meeting. Before the meeting got under way a film entitled "Cross Roads In The Sky", depicting the necessity for a new airport in Cincinnati, was shown.

President *Ezra Blount* then called the meeting to order, asking the Secretary to read various pieces of correspondence from the national office which had been received during the summer. Mr. Blount then announced that the Proposed By-Laws had been returned by the AES Law Committee with only three minor suggestions being made. By unanimous vote the By-Laws were adopted by the Chapter.

Mr. H. C. Irvin, of Allied Research Products, Baltimore, Md., was the guest speaker, and devoted his entire time to discussing "Free Enterprise" with particular emphasis on the American way of life versus socialism and communism.

The meeting was concluded with a social hour sponsored by the *Northwest Chemical Co.*, Detroit.

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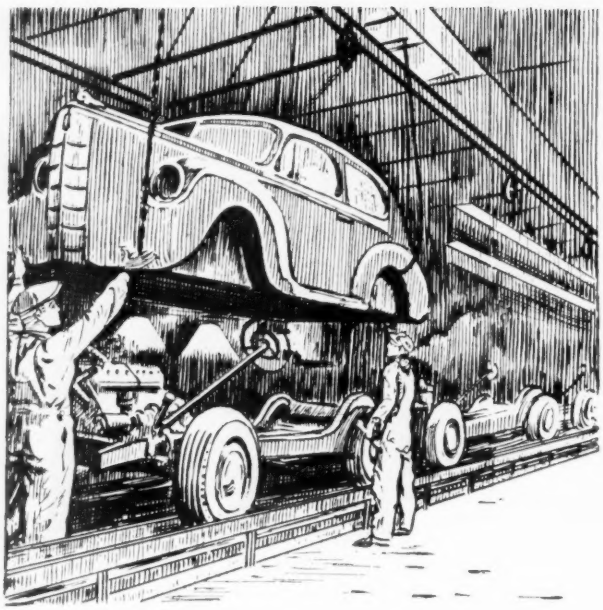


MOTOR CITY PLATING NEWS

by

Edward Finne

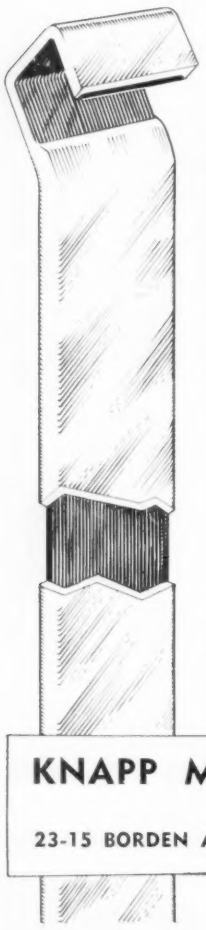
The Solvay Process division of *Allied Chemical & Dye Corp.*, a major producer of soda ash and other chemicals, had been strike bound since June 12. They settled for a 10 cent hourly raise with 5 cents more next March and on each March thereafter through 1953.

Each company also agreed to pay cost of living increases should conditions warrant this.

****

Detroit had the following British metal finishing men as guests during September: *J. N. T. Adcock, N. A. Tope, John Line, E. C. J. Marsh, Bernard Turner, M. F. E. Fry, L. C. J. Connell, N. R. Watts, G. H. Woodall, Dr. Champion, R. H. Willets, Victor Long*, and *R. A. F. Hammond*.

While in Detroit, they visited *General Motors*, Ternstedt plant. *Briggs Mfg. Co.*, and *R. C. Mahon Co.* They also went to Flint to tour the *A. C. Spark Plug Co.* plant and to Grand Rapids to visit the *Dohler-Jarvis Corp.* plants there.



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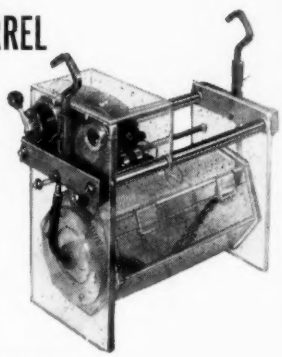

The best looking. The best mechanically. The best in production. The best from any way you look at it. Revolves through the entire plating cycle without transfer of load from one cylinder to another. Made in Two Sizes:

6″ x 12″ and 8″ x 18″

with reversing switch and plug-in cord and with standard perforations of 3/32″ or larger.

Small perforations extra.

As Lucite is non-absorbent, one unit can be used for all solutions and temperatures not exceeding 185°F.

Order today — this is the best investment you can make for your plating room.

STUTZ—Your Guarantee of Quality!

GEORGE A. STUTZ MFG. CO.

PEERLESS PRODUCTS

1645 CARROLL AVENUE CHICAGO 12, ILL.

Before the team left, it was extended a dinner at the Orchard Lake Country Club through the courtesy of *Wagner Brothers, Inc.*

****

Two strikes vitally affecting metal finishers were settled recently. *Wyandotte Chemicals Corp.*, suppliers of alkalies and cleaning compounds, negotiated a settlement of their dispute by giving the chemical workers an additional 10 cents an hour with another 5 cent raise to be added.

****

J. E. Cooper, supervisor of special and sanitary plant engineering for *Ford Motor Co.*, has resigned his position to become active in a new firm specializing in industrial and municipal waste treatment.

He became a partner with *F. W. DuBois* in *DuBois-Cooper Associates*, Detroit.

****

The *Gilbert Tramer Co.*, Cleveland, announces the opening of a Detroit branch office at 6432 Cass Ave. *Homer Sanderson*, with 20 years of servicing the polishing and plating industry, will represent the company at the Detroit office.

****

Metals Finishing Corp., 836 E. Ten Mile Rd., Hazel Park, announces that it has a new tumbling barrel in operation on a 24-hour basis at its plant.

Technical Literature

Hardware Metals and Finishes

By W. A. Mathewson. Published by Hardware Consultant and Contractor 420 Madison Ave., N. Y. 17, N. Y. 52 pages, 8½ x 11.

While written primarily for hardware dealers and architects, this manual is without doubt the most comprehensive and enlightening treatise ever published on hardware finishes, how they are obtained, and the practical utilization of them for decorative and protective effects. The subject is covered in the following chapters;

1—Hardware base metals.
2—Hardware finishes (general information).
3—Natural color finishes on solid metals.
4—Natural color finishes by metallic coatings.
5—Conversion coatings and allied finishes.

THERE IS NO SUBSTITUTE FOR *Experience*

DETROIT
GREASELESS COMPOUND
LEAVES WORK CL
NO CLEANING REQ
The perfection of this product is the direct result of more than 25 years of experience gained in manufacturing many millions of pounds of polishing compounds and other quality-controlled abrasive materials for the production lines of the Automotive Industry and its many suppliers in the field of Metal Finishing. We sincerely believe it to be the best product for the purpose on the market today.
C. H. McALEER, President.

WE KNOW A TEST WILL PROVE

INCREASED PRODUCTION—Scientific "know-how" of the blending of abrasive grains and binders and proper selection of the compound suited for the job gives you the most uniform finish and increases speed of production.

ECONOMY IN USE—The improved and more durable binder gives ideal adhesion to the wheel; drying time and less "off the wheel" wastage.

IMPROVED CONTAINER—Our aluminum-foil container is almost impervious to moisture-loss and when properly stored will remain in good condition for a year.

LABORATORY CONTROL—Constant laboratory control of all raw materials used and experienced supervision of manufacturing processes is maintained at all times.

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COMING EVENTS OF THE A. E. S.

Philadelphia Branch
Annual Educational Session and Banquet
November 18
Broadwood Hotel — Philadelphia, Pa.

Detroit Branch
Annual Educational Session and Banquet
December 2
Statler Hotel — Detroit, Mich.

Newark Branch
Christmas Party and Educational Session
December 16
Hotel Robert Treat — Newark, N. J.

Los Angeles Branch
Annual Convention June 25-28
Biltmore Hotel — Los Angeles, Calif.

6—Coatings; Oils and Waxes.

A most important inclusion in this booklet is a chart which gives the various designations for similar finishes for all the leading hardware manufacturers in the country.

This manual would, in this reviewers opinion, form a logical and easily understood starting point for any student of metal finishes and finishing methods, and should be required reading for all materials engineers concerned with decorative and protective treatments for metals.

W. A. R.

Expired Patents on Metal Cleaners and Detergents

Patent Publications, Dept. MF, P.O. Box #4094 Washington 15, D. C.

The first of a series of reports listing expired patents in certain fields of wide technical interest is announced by this firm, with the recent release of a special grouping of 206 Official Patent Abstracts on the subject of Detergents. The special study on Detergents just released lists patents on that subject dated from November 19, 1929 through May 30, 1933; thus, all have exceeded the 17-year validity period.

The booklet on Detergents contains a total of 206 Patent Abstracts divided as follows: Toilet Soaps, Household and Heavy Duty Cleaners, 54; Metal Cleaning, Pickling and Descaling, 73; Paint, Varnish and Finish Removers, 25; Textile Detergents and Cleaners, 14, and, Miscellaneous, 40. The booklet contains a subject index.

Technical people and technical librarians, patent attorneys, etc., will find this special study of Detergents to be of interest in view of the wide range of products covered by the 206 abstracts and the current expansion in this important field. With this Detergent study readily at hand a considerable amount of labor, expense and time may be saved by researchers in that field. Price of the special Detergent Report No. 1 is $2.

Abrasive Grain Size Standards

Printed copies of *Simplified Practice Recommendation R118-50, Abrasive Grain Sizes*, are now available.

This recommendation covers the allowable limits for the sizing of aluminum-oxide and silicon-carbide abrasives for polishing uses and for grinding wheels. It became effective for the first time in 1930 and was revised in 1936 and 1944.

Heretofore, the recommendation has contained one table of sizes for polishing use and for grinding wheels. The revisions, which was proposed jointly by the Abrasive Grain Association and the Grinding Wheel Institute, provides two tables; one for sizing abrasives for grinding wheels, and another for sizing abrasives for polishing uses. Appropriate changes are made in the sizing and limits of certain grit numbers to make them suitable for these needs. *Mr. Henry R. Power*, of the Carborundum Co., and Chairman of the Standing Committee, summarizes the purpose of the changes as follows:

"Separate tables are required because the standards differ. The polishing grain standards are more critical than is required for abrasives used to make grinding wheels. In the latter application many wheels are mixtures of two or more sizes, hence the sizing of each need not be too critical. Con-

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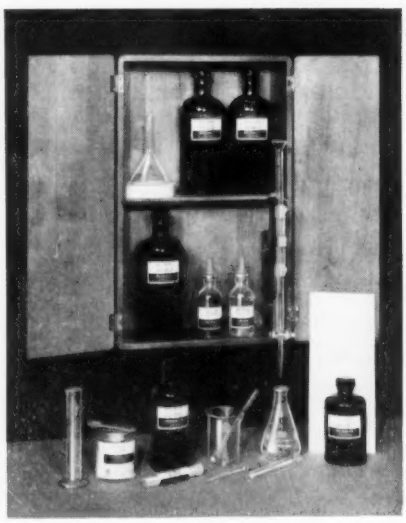

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Investigate Potassium Stannate for both new and existing applications —to increase your output . . . to lower your costs per article plated.

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METAL & THERMIT CORPORATION

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Specialists in Tin

versely, any broader standards that suffice for grains entering wheels, are not sufficiently critical for use in polishing operations where the job is almost invariably done with a single grit size.

"Also the type of abrasive grit, its shape, and treatment, often differs for polishing use from the quality required for wheel use, hence they are not interchangeable."

Printed copies of Simplified Practice Recommendation R118-50, Abrasive Grain Sizes, may be obtained from the Superintendent of Documents, Government Printing Office, Washington 25, D. C. for 5 cents per copy. A discount of 25 per cent will be allowed on orders for 100 or more copies.

Manufacturers' Literature

Surface Active Agents

Alrose Chemical Co., Dept. MF, 180 Mill St., Providence, R. I.

This firm has issued a new bulletin describing their line of wetting and surface active agents and organic chemical specialties. Applications, specifications, properties, chemical formulas are given for over twenty materials in this class. Copies may be obtained by writing to the above address.

Finishes for Aluminum

Reynolds Metals Co., Dept. MF, 2500 S. Third St., Louisville, Ky.

The 1950 edition of the process manual, "*Finishes for Aluminum*", has just been published by this firm. This book is available without charge to engineers, chemists, production men and others when requested on company letterhead.

It includes information on 10 cleaning treatments, 15 mechanical finishes, 16 chemically produced finishes, 11 electrolytic oxide finishes, organic finishes, and specialized finishes such as luminous paints and vitreous enamels. A section is also included on controls and tests.

A feature of the 1950 edition is that all types of finishes in each of the various classifications above are presented in the book in such a manner that the reader can tell which are the commonly used regular commercial finishes and which ones are more or less in the experimental stage. This is important to help orient the reader when selecting a finish for a particular job.

The new edition also contains much data in tabular form including step-by-step schedules for applying various types of finishes, data on properties and characteristics of the aluminum alloys, action of some chemicals on aluminum alloys, their relative resistance to corrosion.

Included for the first time is a guide for approximating typical costs of applying 20 different treatments to aluminum. Another new table gives typical finishing practices for a wide variety of aluminum products to serve as a suggestion when selecting a finish.

The new 124-page, 6 x 9-inch book contains 37 illustrations, 18 tables, a table of contents, and an itemized cross index. It is wire bound to lie flat when opened. Also it carries a color-identifying tab on the backbone and across the page edges at the top of the book. This facilitates identifying the book either on a bookshelf or in a briefcase.

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of the following SCRAP

- **Ni**—*Anodes*
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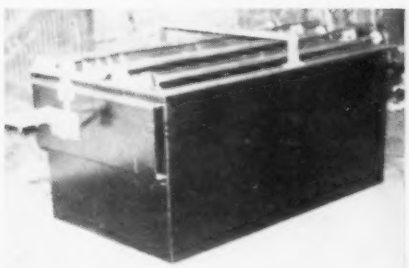
- **Ni**—*Deposited Iron Hooks, Racks, Hangers*
- **Tin**—*Plating Residues*
- **Cadmium**—*Trees, Strippings, Nodules, Residues*
- **Molybdenum—Tungsten**
- **Gold**
- **Platinum**—*Scrap, Residues, Strippings*

Write indicating grade and quantity available

METALLURGICAL PRODUCTS CO.
ESTABLISHED 1909
35th & Moore Streets, Philadelphia 45, Pa.



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TAKE steps now to hold future maintenance costs in check by utilizing fully the advantages of corrosion-resistant materials. Pictured above is a rubber lining, steam pressure vulcanized and securely bonded to a Stortswelded tank — for nickel plating service. Storts also furnished the copper work. This tank will be free from repair or replacement charges for years to come. You too can hold your future costs in check if you will bring your tank maintenance problems to Storts.

STORTS WELDING COMPANY INCORPORATED

38 Stone Street
MERIDEN, CONN.

Manufacturers of Welded Fabrications to Specification

Abrasive Polishing Grain

Simonds Abrasive Co., Dept. MF, Philadelphia 37, Pa.

A new bulletin recently published by this firm gives a complete description of Simonds polishing grain, including details of their testing and control methods, recommendations for use in polishing various types of metal parts, and polishing wheel set-up information. Copies of this free bulletin are available by writing to the above address. In addition to polishing grains, the firm also manufactures a complete line of abrasives for blasting and tumbling work. Special grains for floor anti-slip coatings are also furnished.

Polishing and Buffing Compositions

Frederick B. Stevens, Inc., Dept. MF, 1800 18th St., Detroit 16, Mich.

Buffing Composition Catalogue #50 issued by this company gives details on their complete line of polishing and buffing compositions for all types of metal finishing operations. The various standard sizes available, grades, and recommended apolications are described. The firm has an extensive Customer Service laboratory for evaluating compositions and solving customer problems, the work of which is also described in this bulletin. Free copies are available by writing to the above address.

Burnishing Balls and Shapes

The Abbott Ball Co., Dept. MF, 1046 New Britain Ave., Hartford 10, Conn.

Useful information on deep-hardened carbon steel Bearing Balls, Burnishing Materials and Barrel Finishing equipment is contained in a new, multipage Catalog-Manual issued by this firm.

The new booklet, a practical reference handbook for industrial users. Information contained in the book's four Sections includes pertinent facts and figures on: Bearing Ball classifications and applications; Selection, use and care of Burnishing Materials; Practical Barrel Finishing; and Lithographic Plate Graining. Tables and charts giving sizes, tolerances, quantities and shipping weights are also included along with detailed information on Abbott methods of packaging.

Corrosion-Proof Cements

Atlas Mineral Products Co., Dept. MF, 43 Walnut St., Mertztown, Pa.

This firm announces the publication of their new bulletin No. 5-1 on *Corrosion Proof Cements*. This bulletin describes their complete line of Resin, Sulfur, Silicate and Asphaltic Cements. Information on each cement is compiled in handy chart form which is helpful in the selection of the correct cement for a specific application.

Write to the above address for your copy of this new bulletin.

Filters for Plating Baths

Titeflex, Inc., Dept. MF, 500 Frelinghuysen Ave., Newark 5, N. J.

A new 8-page booklet describing its line of filters has just been issued by this firm. Printed in two colors, the booklet gives detailed information on sizes, capacities and motors, as well as descriptions of the variou metals from which the filters are constructed.

Bright Zinc the easy way

McKeon's

Zinc-Brite

TRADE MARK REG'D.

INSURES CONSTANT PURIFICATION

through the precipitation of heavy metal impurities.

Effectively cleanses your zinc solution of copper, cadmium, lead, tin, mercury, and like contaminations as fast as they get into your electrolyte either from the anodes, work, or external sources.

Prevents harmful accumulation of carbonates.
No filtering required. No waiting period. Economical.

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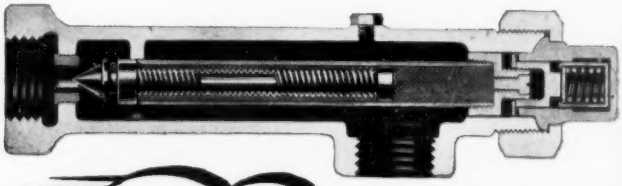
INTRODUCTORY OFFER: 1 gallon McKEON'S "ZINC BRITE" with complete set of operating instructions, enough to operate 250 gallons of solution for approximately 1 month, $3.25.

Sulphur Products Co. Inc.
Greensburg 7, Pa.



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Ideal for outdoor tanks and steam lines. No steam wasted by re-evaporation. Cannot freeze. The same unit, known as The Sarco Thermoton, may be used as an approximate temperature control. Ranges 75 to 125° to 170 to 220°F. Catalog Nos. 250 and 550.

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IMPROVES PRODUCT QUALITY AND OUTPUT

In addition, it illustrates and describes the complete operating cycle of Titeflex filters including the unique backwash system which permits cleaning in minutes without the use of manual labor. Copies available upon request to the manufacturer.

Strippable Coatings, Adhesives

Minnesota Mining and Mfg. Co., Dept. MF, 900 Fauquier St., St. Paul 6, Minn.

Properties of over 100 industrial adhesives, coatings and sealers — including strippable coatings for protecting metal finishes — are described in a new catalog available from this firm.

The 32-page booklet — "3M Adhesives, Coatings and Sealers" — announces that more than 1,000 formulas are available, and offers research help for industrial customers in selecting the right product for the job.

Tables of properties cover:

Strippable coatings that can be applied by crush, spray or dip for protecting highly polished metal surfaces during fabrication, shipping and storage.

Permanent coatings to protect metal against corrosion and abrasion, to insulate motor housing, and to sound deaden metal panels.

Adhesives for bonding metal, rubber, glass, plastics, fabrics and wood to themselves and to other materials.

And sealers such as used in manufacturing auto bodies, refrigerators, fuel tanks, wood decks, and pressurized aircraft cabins. The catalog also includes special sections of "Coro-Gard" protective coating systems and a specialized adhesives, coatings and sealers for the shipbuilding industry, the construction trades and the oil industry.

pH Meters

Wilkens-Anderson, Dept. MF, 4525 W. Division St., Chicago, Ill.

The above firm offers a bulletin on the new "A.C." Coleman pH Meter, model 18. The bulletin explains the advantages of this new meter for electroplaters. The unit is easily operated by simply plugging into a circuit — no batteries are employed. In requesting copies of this bulletin ask for *Free Bulletin* PF-12.

Steel Shot Blasting Abrasive

American Wheelabrator and Equipment Corp., Dept. MF, 752 South Byrkit St., Mishawaka, Ind.

A new bulletin on Tru-Steel shot, a newly developed abrasive for blast cleaning, is now available from this firm. Tru-Steel shot is a tough, hard, fully heat treated abrasive that wears down slowly but does not break down, it is claimed.

The booklet shows photographs of Tru-Steel shot after various periods of wear life, and compares it with photographs of other abrasive after the same period of wear. Case studies, supported by letters showing the advantages in faster cleaning time, lower maintenance costs, reduction in abrasive consumption, and improved product finish, are featured.

A free copy of Booklet No. 59 may be obtained by writing.

Water Flow Regulator

W. A. Kates Co., Dept. MF, 430 Waukegan Rd., Deerfield, Ill.

The Kates regulator is completely self-contained and entirely independ-

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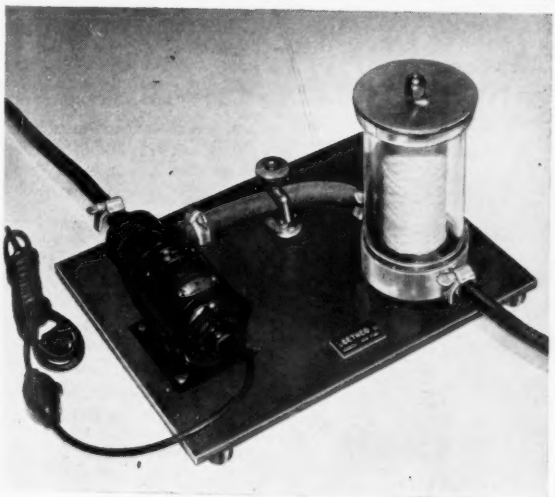

MODEL LSU-5

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- **CONSTRUCTION** — High temperature lucite filter cylinder. Highest quality stainless, type 316, pump & fittings.
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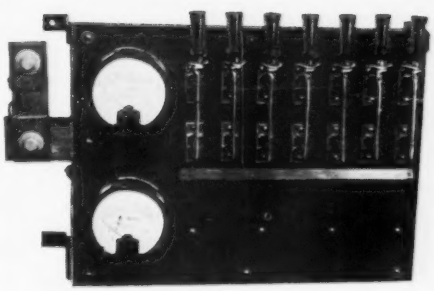

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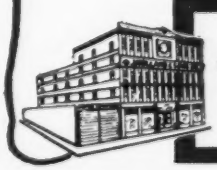
Various sizes — with and without meters.

Write for FREE folder "P" showing our wide selection of metal finishing equipment.



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ent of air lines, electric current, remote valves or other connected apparatus. It is available for controlling flow of water, acids or oils at high or low temperature and high or low pressure, at flow rates from 0.1-100 g.p.m.

A copy of Bulletin No. 502 which clearly explains the operation of the Kates Direct Acting Flow Regulator will be sent free upon request to the Kates Company.

Pressure and Temperature Regulators

Spence Engineering Co., Dept. MF, Walden, N. Y.

A new 32-page booklet containing useful information about pilot-operated pressure and temperature regulators is available from this firm.

Illustrated with photos, charts and tables, the new booklet discusses main valves, controls and strainers, gives capacity and flow data as well as dimensions and weights.

Case example problems are cited to help users select the correct type and size regulator for a particular application. Special sections of the new booklet treat in detail such subjects as thermostats, superheaters, electrically-controlled regulators, strainers and flange standards.

Manpower Planning for National Emergency

Policyholders Service Bureau, Metropolitan Life Insurance Co., 1 Madison Ave., New York 10, N. Y.

The lack of a sizable pool of unemployed means that a large-scale reshuffling of the current labor force, rather than the addition of large numbers of workers, will be necessary in case of a major mobilization for national defense.

This is one of the factors in the manpower problem pointed out by the report, "Manpower Planning for National Emergency," just issued by the Metropolitan Life Insurance Co.

This report is based on a survey of key industries and federal agencies conducted by the Metropolitan to find out what is being done and can be done by industry in voluntary manpower planning. It is designed to assist management in locating the most likely problem areas in emergency planning.

In order to provide practical guidance in manpower planning, the report examines the problem from these angles: the manpower problem; placing the responsibility for planning; the company's role during national emergencies; conducting and analyzing an audit of current personnel; filling the manpower gaps; company policies regarding national emergency leaves; and other considerations such as civil defense and safeguarding health, safety and security of employees.

In addition, the report shows the emergency plans and activities of business organizations and chambers of commerce; deferment guides, methods of rating manpower utilization, and a preparedness check list for management.

While this report was prepared primarily for the use of executives whose companies insure their employees under Metropolitan group policies, as long as the supply lasts copies may be obtained by other executives who write in on their business stationery.

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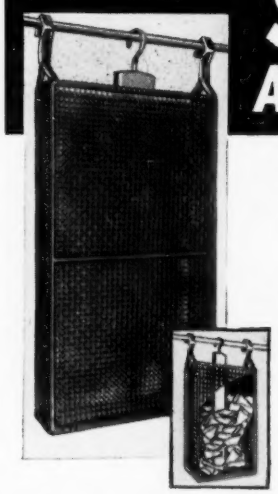
*Patent No. 2,519,275. Other patents pending.



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Utilize valuable anode scraps with BELKE Anode Baskets. Merely suspend an anode in center of basket and pour anode scraps in around it.

Built for long service, BELKE Anode Baskets are ruggedly constructed of heavy gauge, steel wire-mesh reinforced with frame of welded steel rod. Heavy coating of BELKE Universal Plastic assures protection against all plating solutions.

Made to specified dimensions. For quotation send length, width, and depth of basket you require—or ask your BELKE Service Engineer.

BELKE DIPPING BASKETS—Wire or perforated sheet metal construction in round or rectangular shapes—of steel, stainless steel, aluminum, Monel, Nichrome, copper or brass—uncoated or coated with BELKE Universal Plastic. Many standard sizes, or can be made to order. Write for prices.

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947 North Cicero Ave.
Chicago 51, Ill.

EVERYTHING FOR PLATING PLANTS

pH Electrodes

Leeds & Northrup Co., Dept. MF, 4934 Stenton Ave., Philadelphia 44, Pa.

The complete line of Leeds & Northrup pH electrodes and assemblies for both industrial and laboratory applications is now presented for the first time in a new, 28-page catalog, "pH Electrodes, Assemblies, Parts and Accessories."

This publication is designed to help present users of L&N pH equipment in ordering replacement parts and to guide new or prospective users in selecting the proper electrodes to solve their pH problems.

It lists the advantages of each type of electrode, and by means of an illustrated, double-page spread, shows each assembly and all of its components in tabular form. Glass electrodes for industrial use are shown in detail, whether for use in plastic, Pyrex or iron assemblies; glass electrodes for laboratory use are illustrated with their appropriate measuring instruments. Other L&N laboratory electrodes—hydrogen, quinhydrone, oxidation-reduction — are listed with their reference electrodes.

Assessories and supplies, such as buffer solutions, chemicals, holders and mountings are listed. Also included briefly are the portable and permanently-mounted instruments — L&N indicators, and Micromax and Speedomax recorders and controllers —that are used with these electrodes.

For a copy of this publication ask for Catalog EN-S5.

Rust Preventatives

Rust-Oleum Corp., Dept. MF, Evanston, Ill.

Rust-Oleum's story of industrial rust prevention is told in the new catalog now being issued by this company.

Directions relate to uses for general exposure and special conditions which produce rust, for machinery and implement finishes, heat-resistant and chemical-resistant coatings, floor coatings, etc., and include three dozen different kinds of service and application. The company's popular sealers for materials other than iron and steel are also featured.

One of the most important advantages of the new catalog is the extensive showing of color chips. There are at least seventy colors plainly designated and reproduced. The specification descriptions are complete, clearly indicating resistant qualities, drying time, thinner requirements and methods of application. Any industry seeking to

PLATERS RESEARCH Control Systems FOR THE ANALYSES OF PLATING SOLUTIONS

Years of experience by the chemists of one of the leading consulting laboratories in the field of electro-plating has demonstrated time and again the value of Platers Research Control Systems.

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For platers who prefer them, reagents to any normality or specification, indicators and rare chemicals.

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pH PAPERS

Accurate—Convenient—Time-saving

instantaneous pH check right at the tank.

Plating ranges (200 strips per box)

Acid:	Alkaline:
*4.8-6.2	6.6- 8.1
*3.6-5.0	8.2- 9.7
*2.4-3.9	8.8-11.3
1.0-2.8	11.0-13.1
0.4-1.4	

*Electrometric Values in Nickel Solutions.

Each range is boxed separately.

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your nickel stripping bath by adding
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Cuts acid consumption . . . protects base metal . . . reduces pitting and roughening . . . minimizes need for buffing and coloring.

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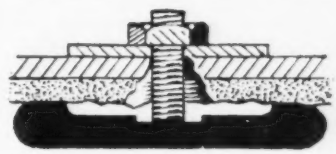

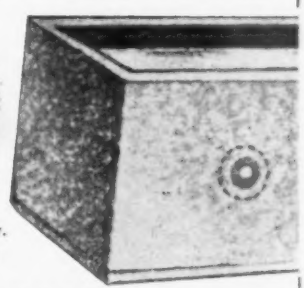

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